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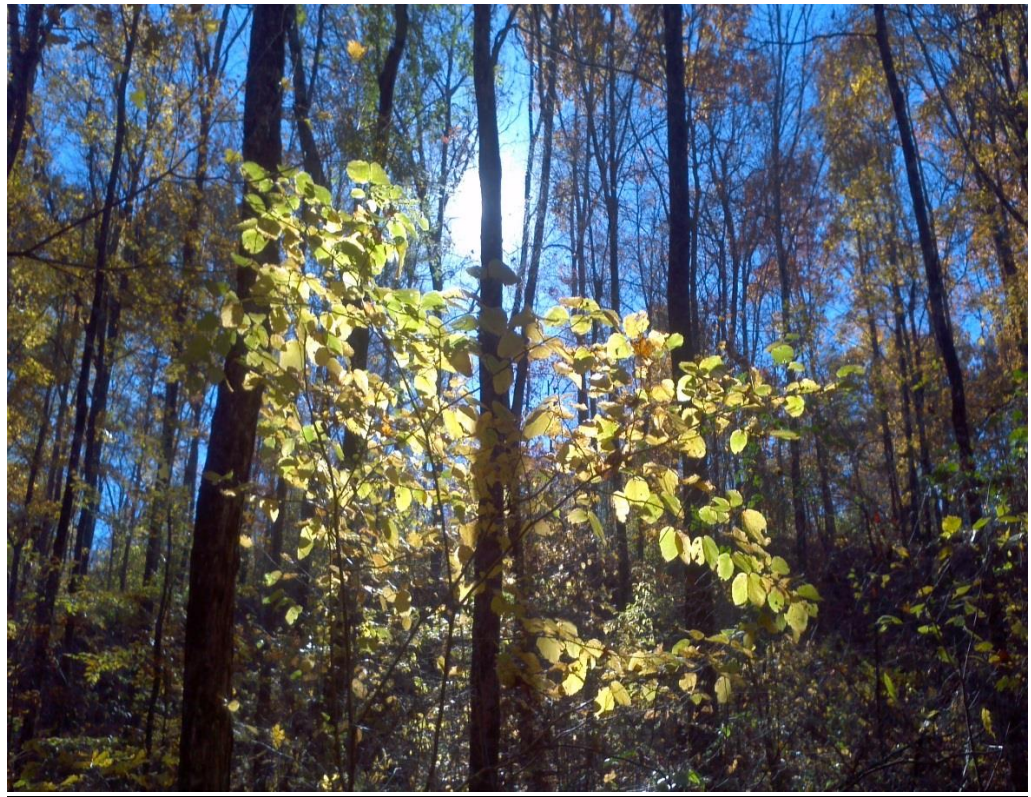
August 2016



# FINAL Environmental Assessment

## Brushy Mountain Project

**Pleasant Hill Ranger District, Ozark – St. Francis National Forests  
Johnson County, Arkansas**



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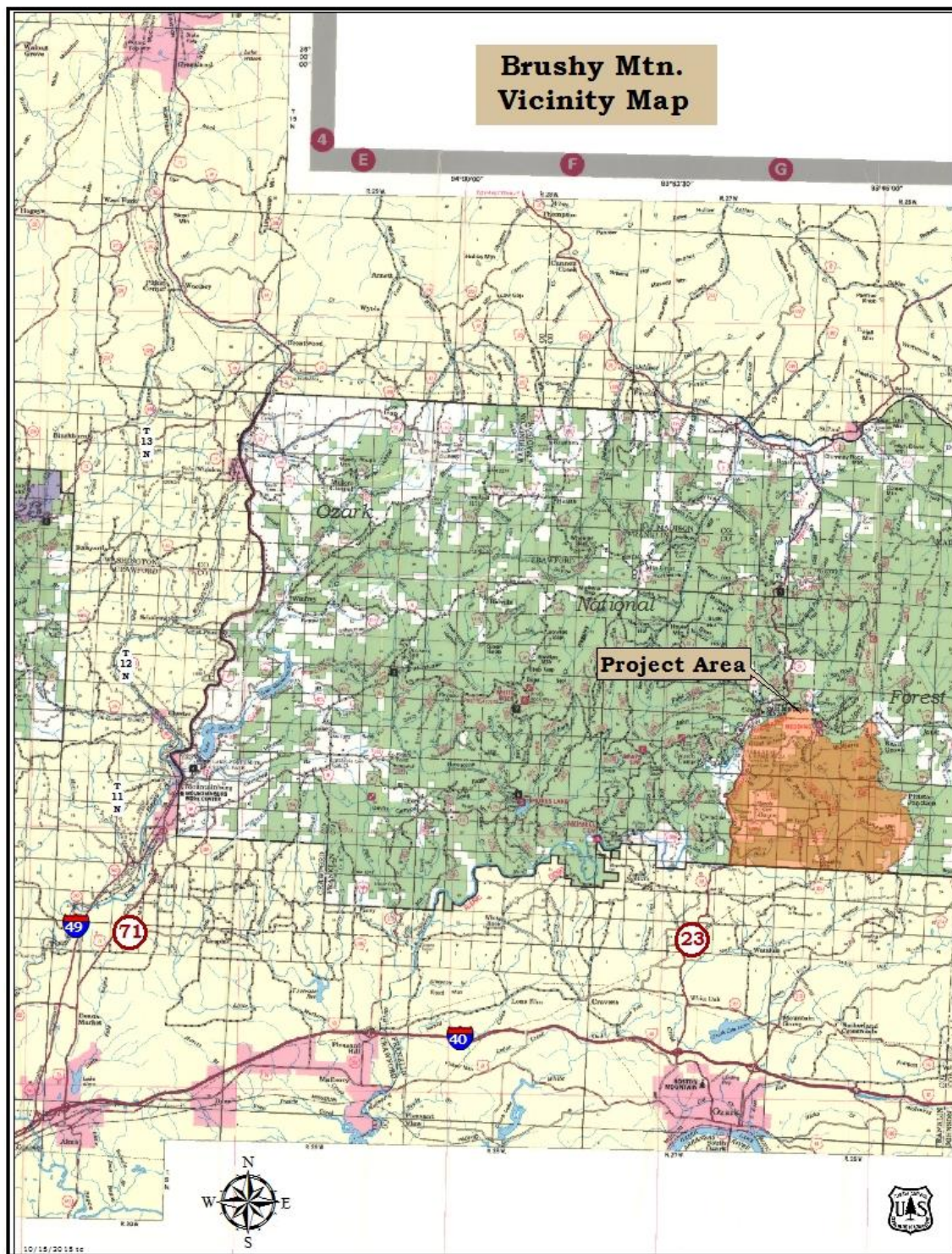
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**Additional project maps are attached with the EA.**

## SUMMARY

The Pleasant Hill Ranger District will implement forest management activities to improve ecosystem health, manage vegetation to improve forest stands, enhance wildlife habitat, and improve recreational opportunities in the **Brushy Mountain** project area of the Ozark-St. Francis National Forests (OSFNFs) located in Franklin County, Arkansas. These actions will include enhancing wildlife and fish habitat; thinning timber for biodiversity, forest health, and visual quality; decommissioning roads (some by gating) while improving others; and reducing the build-up of hazardous fuels through prescribed burning. The activities will occur on *federal lands only*. The project area of **Brushy Mountain** encompasses approximately 17,108 total acres; 12,707 acres of which are situated on National Forest land and 4,401 acres are private land. The Brushy Mountain project area includes compartments 411, 412, 413, 414, 415, 416, 417, and 418. The legal description is T12NR27 sections 24, 25, 26, 35, 36; T11NR27 sections 1, 2, 11, 12, 13, 14; T12NR26 sections 19, 20, 27, 28, 29, 30, 31, 32, 33, 34; and T11NR26 sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18 (Figure 1). The project area is bounded on the north by the Mulberry Wild and Scenic River and Scenic Byway 215. The Low Bridge and Pink Twist roads are the east boundaries, State Highway 23 is located on the west boundary, and on the south is the Ozark National Forest boundary.





**Figure 1. Vicinity Map**

The Brushy Mountain project area falls within the following management areas (MAs): High Quality Forest Products (3.E), Mixed Forest (3.C), Scenic Byway Corridor (1.H), Designated Wild and Scenic River (1.C), Riparian Corridor (3.I), and Developed Recreation Area (2.C).



The purpose and need of this project will follow the guidelines of the designated management areas recognized within the Brushy Mountain project according to the 2005 Revised Land and Resource Management Plan (RLRMP) (also referred to as the Forest Plan throughout this document) for the OSFNFs.

As mentioned in the summary of this document, all work will occur on National Forest lands *only*. No work will occur on privately-owned land. However, the Forest Service will solicit cooperation with private landowners via Wyden/Stevens agreements, which allows the Forest Service to carry out prescribed burn treatments on private lands surrounded by or adjacent to federal land in areas where it will improve Forest Service burns.

Thinning forest stands will promote vigor and thriftiness of the remaining trees. Prescribed burning and herbicide/handtool treatments will follow thinning of pine to stimulate plant communities beneficial to wildlife. Timber products in the form of sawlogs, small roundwood, and firewood will be generated by these actions in the near term as well as providing for a future sustainable supply. Habitat diversity for animals and plants, including threatened, endangered, and/or sensitive species will be maintained or improved by the effects of the timber, wildlife, recreation, and access management. Also, fisheries habitat will be enhanced via riparian improvements. Reduction of wildfire risk by prescribed burning and mechanical fuels reduction will also occur as well as closing roads no longer needed for land management. This project will maintain or improve the plant and animal diversity to meet overall multiple-use objectives as described in the RLRMP.

**Table 1. Summary of Projects - Alternative 2 (Selected Action)**

Activity	Number of Units	Approx. Acres Miles
<b>Vegetation Management</b>		
Pine seedtree	2 stands	45 acres
Pine Thinning	59 stands	2,580 acres
Hardwood Shelterwood with Reserves	2 stands	52 acres
Hardwood Thinning	8 stands	282 acres
<b>Fire</b>		
Prescribed Fire/Hazardous Fuels Reduction/Site Preparation/Wildlife Burning/etc... -Federal Lands	All stands	Up to 12,707 acres
Prescribed Fire –Hazardous Fuels-Private Lands	Several	Up to 4,401 acres
<b>Wildlife Management</b>		
Wildlife Openings (New)	10 openings	Approx. 19 acres
Existing Wildlife Openings (Reconstruction)	22 openings	Approx. 41 acres
Wildlife Stand Improvement (WSI)	Stands	Approx. 318 acres
Fish Habitat Improvements (Large Woody Debris)		Approx. 9.4 miles
Glade Restoration		4 acres
NNIS Treatment	throughout project area as appropriate	Not to exceed 500 acres (annually)

**Table 1. Summary of Projects - Alternative 2 (Selected Action) (Cont'd)**

<b>Road Work</b>		
Road Reconstruction	(FS) 1500A, 94411A, 94411H, 94412A, 94413A, 94413B, 94414H, 94415E, 94416H, 94417B, 94417C, 94418A, 94418B, 94418F, 94418N	Approx. 8.8 miles
Road Maintenance (Forest & County Roads)**	(FS) 1003N, 1480, 1500, 1500B, 1504-3 1504A, 1543, 4408, 4409, 4410, 4411, 4412, 4443, 94411E, 94411K, 94412A, 94414A, 94414B, 94415A, 94416E, 94417A, 94418A, 94418C, 94418D, 94418H, 94445B, 94445D	33.6 miles
Road Decommissioning	(FS) 1500B, 94411G, 94412A-1, 94412A-2, 94412C, 94413C, 94414B, 94414C, 94414I, 94416A, 94416C, 94417E, 94417G, 94418G, 94444C, 1500A, 94411B, 94411C, 94411D, 94411F, 94411G, 94411H, 94411J, 94411K, 94411L, 94411N, 94413A, 94414A, 94414B, 94414D, 94414E, 94414F, 94416B, 94417C, 94418C, 94418D, 94418L, 94418O, 94418P, 94445G	18.6 miles
Temporary Roads	1500B, 94411G, 94412A-1, 94412A-2, 94412C, 94413C, 94414B, 94414C, 94414I, 94416A, 94416C, 94417E, 94417G, 94418G, 94444C	4.4 miles
Gate Installation	12	
Cultural-Heritage Sites	39 total known sites	11 sites recommended eligible for listing, 14 site recommended ineligible for listing, and 14 are undetermined

\***Prescribed Fire-Private Lands** – pending landowner approval through Wyden and Stevens Agreements only.

\*\***Road maintenance** includes both Forest Service and County roads.

The selected action aims to restore forest ecosystem health and sustainable forest conditions in an area which has been affected by oak decline and exclusion of fire. Vegetative and wildlife diversity will be increased, fuels accumulations will be reduced, forest products will be produced and watershed quality and dispersed recreation quality will be improved in the area.

Alternative 1 and alternative 2 have been evaluated and is described below:

- Alternative 1 – A “No Action” alternative where the present/existing level of management will continue in the analysis area.
- Alternative 2 – A “Selected Action”

Based upon the effects of the alternatives, the responsible official decided which alternative best met the purpose and need identified for this project area. The District Ranger of the Pleasant Hill Ranger District has the authority to make this decision.

## **Part 1 – Introduction**

### **Document Structure**

The Forest Service has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the direct, indirect, and cumulative environmental effects that will result from the selected action and alternatives. The document is organized into five parts:

- ***Part 1 - Introduction:*** This section includes information on the history of the project selection, the purpose and need for the project, and the agency's proposal for achieving this purpose and need. It highlights implementing activities in MAs transitioning from current conditions to the desired future conditions under the direction of the RLRMP. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- ***Part 2 - Comparison of Alternatives, including the Selected Action:*** This section provides a more detailed description of the agency's selected action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- ***Part 3 - Environmental Consequences:*** This section describes the environmental effects of implementing the selected action and other alternatives. This analysis is organized by resources potentially affected. Within each section, the affected environment is described first, followed by the effects of the no action alternative that provide a baseline for evaluation and comparison of the other alternatives.
- ***Part 4 - Consultation and Coordination:*** This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- ***Part 5 - Appendices:*** The appendices provide more detailed information to support the analyses presented in the EA.

Additional documentation, including more detailed analyses of project-area resources may be found in the project planning record located at the Pleasant Hill Ranger District office in Clarksville, Arkansas.

### **Background**

The Pleasant Hill Ranger District's "order of entry" led to this project proposal. The RLRMP guides activities for a 10 to 15 year planning period and directs that all land types be inventoried within that timeframe. The Brushy Mountain project area was due for inventory, treatment, and monitoring. Foremost, this analysis addresses forest health and

diversity, as identified by the interdisciplinary team members. This source document is on file at the Pleasant Hill Ranger District office.

### **Purpose and Need for Action**

The purpose of this initiative is to:

1. Move forest condition toward the desired future conditions described in the forest plan. ([http://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/fsm8\\_042809.pdf](http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm8_042809.pdf))

In doing so, the Forest Service will restore ecosystem health and sustainable conditions by:

- Reducing basal area (stand density) and restoring the historic/natural fire regime to diminish fire danger and benefit forest communities.
  - Increase plant and animal diversity.
  - Reduce fuel loads in order to protect forest ecosystems and private property that are at risk.
  - Improve forest health so that stands are more resistant to stress, insects and other pathogens caused by drought, overcrowded conditions and trees reaching older ages. This will be done by thinning overcrowded stands of trees and regenerating new stands of the current species at the appropriate time.
  - Protecting watershed integrity with responsible forest management via vegetation treatments that will ensure continued diversity and vigorous growth while maintaining high water quality.
  - Protecting watershed integrity by closing and decommissioning unneeded roads, thus reducing sedimentation flow into stream channels. Further, riparian stand improvement measures will help ensure flood events are ameliorated by slowing high water and filtering debris and sediment to reduce scouring of streams.
2. Increase habitat potential for early-successional, disturbance-dependent species.
  3. Manage dispersed recreational opportunities while protecting the environment.
  4. Increase Forest visitor safety.
  5. Provide forest products to industry and the public.
  6. Maintain habitat for both aquatic and terrestrial species inhabiting the Mulberry River corridor.

This action responds to the goals and objectives outlined in the 2005 RLRMP for the ***High Quality Forest Products, Mixed Forest, Scenic Byway Corridor, Designated Wild and Scenic River, Riparian Corridor Management Areas, and Developed Recreation Areas***. These actions will help transition the project area toward desired conditions described in the plan. The priorities described in the Forest Plan are as follow:

### **3.E HIGH QUALITY FOREST PRODUCTS**

- Support a balanced age class distribution of native tree species capable of sustained, high-value timber production.
- Implement prescribed burns on 3- to 10-year intervals.
- Provide a variety of motorized and non-motorized recreation opportunities.

### **3.C MIXED FOREST**

- Manage for pine and oak woodlands on the lower quality sites.
- Manage for medium density or balanced age classes on medium and high quality sites.
- Implement prescribed burns on 3- to 10-year intervals.

### **1.H SCENIC BYWAY CORRIDORS**

- Maintain or improve biological communities to provide attractive settings for visitors.
- Provide for the protection of rare communities and threatened, endangered, sensitive, and locally rare species.
- Preserve viewshed quality.
- Develop public view points and interpretive opportunities.
- Promote and manage the scenic byway for the traveling public and benefit of local communities.

### **3.I RIPARIAN CORRIDORS**

- Maintain, restore, or enhance biological integrity of aquatic communities.
- Identify roads and trails that should be reconstructed or decommissioned to reduce sediment and improve watershed conditions.
- Include erosion and sediment control measures in all ground-disturbing project plans.
- Ensure floodplains properly function as retention storage areas for floodwaters.
- Maintain water quality within a range that ensures survival, growth, reproduction, and migration of aquatic and riparian wildlife species.

### **1.C DESIGNATED WILD AND SCENIC RIVERS**

- Enhance and protect the outstandingly remarkable values.

- Protect and preserve the natural environment and natural processes from human influences.
- Manage as semi-primitive, motorized, or roaded natural.

## **2.C DEVELOPED RECREATION AREA**

- Operate and maintain developed recreation areas appropriately and be responsive to user demand.

The following management prescriptions are needed and will be implemented within the Brushy Mountain project area:

### **Ecosystem Restoration and Promoting Sustainable Ecosystems**

The project area was historically subject to a more frequent regime of vegetation disturbance from anthropogenic fire. The OSFNFs have study sites in which frequent fire return intervals have been documented. Here, mean fire-return interval for the period of 1680-1820 ranged from 4.6 to 16 years, for the period of 1821-1880 it ranged from 2 to 3.1 years and for the period of 1881-1920 it ranged from 1.4 to 5 years. From 1921-2000 mean fire-return interval for these study sites ranged from 62-80 years (Guyette and Spetich, 2003). Anthropogenic fire is documented to have played a major role in shaping ecosystem structure in the Ozark Highlands. Documented presence of native peoples in the area prior to the earliest fire scars recorded in this study point to a fire regime with return intervals similar to that documented for the period of 1680-1820. Frequent fire in forest/woodland ecosystems would invariably have produced open, less dense stands with a higher proportion of vegetation adapted to fire. Displacement of anthropogenic fire, creation of barriers to fire such as roads and a long-standing policy of fire suppression have led to current forest health problems associated with abnormally dense forest conditions and unsustainable ecosystems.

Historically, the lands that are now the OSFNFs consisted of fire-dependent woodland and forest ecosystems with well-developed herbaceous understories. Currently, the sustainability of ecosystems in the project area is in jeopardy because the area lacks these forest conditions. This absence is due to a century of fire suppression and lack of vegetation management. Existing ecological conditions in the project area include dense, overstocked forest, a shift from the historic plant community composition toward fire-intolerant plant species, lack of herbaceous species diversity, and insect epidemics.

General guidance in the 2005 RLRMP guides the Forest Service to “Respond to land, resource, social and economic changes.” Forest health and insect epidemics have become of paramount importance on the OSFNFs within the past few years. A red oak borer epidemic has materialized with affected acreage going from 19,000 acres in 1999 to around 300,000 in 2001. The basic reason for this epidemic can be attributed to excessive forest density resulting in stressed trees. Preliminary field investigations indicate that the red oak component is being reduced by as much as 85% within the affected areas. The Pleasant Hill Ranger District was the hardest hit area of the entire forest. It is where the epidemic first started and where evidence of the epidemic still exists. Preventive action is limited, but it is thought the best hope lies in regeneration and thinning (harvest & salvage). This will accomplish two objectives: (1) reduce inter-tree competition and relieve the water



stress on the remaining trees and help them repel some of the borers, and (2) the trees that are harvested will be able to begin stump sprouting which will help to provide a source of young oaks for the future.

Oak decline has been diagnosed as far back as the late 1980's (Evaluation of Oak Decline Areas in the South: Protection Report R8-PR 17 September 1989). Oak decline is a complex syndrome with multi-factor causal agents that lead to dieback symptomologies and mortality. The key symptom characterizing oak decline is progressive crown dieback followed by mortality which may take a period of years. Oak decline results from tree stressors that have: (1) long-term predisposing factors such as adverse climatic trends, poor site conditions, tree age or genetics; (2) short-term inciting factors like drought, late spring frost/freeze, insect defoliation, or discrete air pollution events; and (3) long-term contributing factors such as root disease, bark beetles, canker, or decay fungi. Any combination of these factors results in triggering an oak decline.

Returning a prescribed fire rotation mimicking historic (*prior to 1920*) fire return intervals following thinning/regeneration harvest would maintain open forest conditions with reduced inter-tree competition. The thinning of pine stands is also important in preventing disease attacks from southern pine beetles. These beetles have been spreading across the south in recent years due to the increasingly hot summers and mild winters. Infestations are now common in areas where the beetle was once relatively unknown. South Carolina, North Carolina and Kentucky have had tremendous outbreaks within the last five years. Shortleaf pine has been almost completely wiped out on the Daniel Boone National Forest in Kentucky. To date, only small infestations have been observed on the Ozark National Forest (Mt. Magazine Ranger District), yet southern pine beetles are common to the Ouachita Mountains and southern Arkansas. Once insect infestations start, it is too late to effectively treat large areas and many acres of trees die rapidly. Prevention is the control method of choice by thinning stands to reduce inter-tree competition and relieve moisture stress. By keeping the trees healthy, beetles are expelled from the trees and never reach epidemic proportions.

Watershed integrity is sustained by mimicking the natural vegetation occurrences. This is done through stand manipulation via timber & wildlife management and prescribed fire.

### **Improve Wildlife Habitat and Benefit Disturbance-Dependent Species through Establishment of Early Seral Habitat.**

The Forests provide a wide variety of habitats that support a diversity of wildlife species. One of the two most important is the early-successional habitat, (0-10 years old). Five of the Management Indicator Species (MIS) from the RLRMP are dependent upon early-successional habitat. Reestablishment of young forests ensures sustainability of that forest type for another cycle. Two MIS are dependent upon open forest conditions/woodlands.

These disturbance-dependent MIS species population trends have been analyzed utilizing a variety of sources (AGFC 2001, 2006 & 2007; USDA 2001; USDA 2007 and NatureServe 2006). Population monitoring associated with these sources shows the status of these seven species as such:

- Deer populations have generally increased in the last two decades based on harvest data.

- Black bear populations are increasing; however, to maintain quality habitat over time, there is a need to maintain early-seral habitat.
- Northern bobwhite populations are decreasing due to a lack of pine/oak woodland and native grassland areas.
- Population trends for turkey are stable to declining. This is a result of poor brood recruitment for multiple consecutive years. In addition, downward trends in early-successional habitat would likely produce a negative effect on brood habitat in the future for turkey.
- Prairie warbler populations are decreasing primarily due to lack of young age-class forest (regenerating forest communities).
- Brown-headed nuthatches are dependent upon open pine forest and woodlands. Populations of this species are stable, but available habitat is a limiting factor.
- Red-headed woodpeckers are dependent upon open oak woodlands. Populations of this species are stable to decreasing. Available habitat is a limiting factor.

For the Forests, the amount of early-successional forest habitat increased slightly from 1986 to 1991 to a total of approximately 1.0% forest-wide. From 1991 to 2001 early-successional forest habitat declined forest-wide to approximately 0.2%. The amount of early-successional habitat on the Forests is tied very closely to the amount of regeneration harvests the Forests conduct in a given year. This type of harvesting has declined over the years and this has driven the decline in early-successional habitat.

Hunter (2001) identified species of disturbance-dependent birds which are declining in the central hardwoods area. Forty-three of these species potentially occur within the analysis area. Of these, the United States Fish and Wildlife Service (USDI, 2002) identified seven of these species as Bird Species of Conservation Concern that are declining in the Central Hardwoods Bird Conservation Region (BCR), and are disturbance-dependent species. These 43 species found within the analysis area would benefit from vegetation treatments due to their reliance upon disturbance-associated habitats (Hunter, et al., 2001).

### **The Need to Reduce Off Highway Vehicle (OHV) Conflicts with Other Resource Values**

Unauthorized OHV use in the project area (occurring off designated roads) is causing resource damage and conflicts with other resource uses. Closing and decommissioning roads in the project area will greatly reduce the negative impacts created from unauthorized OHV use and improve watershed integrity. The Forests' OHV policy designates particular routes on which it is authorized to ride on National Forest roads.

### **The Need to Improve Forest Visitor Safety**

Red oak borer-caused mortality and associated oak decline have increased the potential for falling trees/limbs to injure forest visitors. Additionally, ice storms within the last several years have created snags, broken tree tops, etc... which pose a threat to visitor safety.

Thinning forest stands near recreation areas and implementing associated silvicultural treatments and prescribed fire will reduce potential hazards and improve visitor safety.

### **The Need to Provide Wood Products**

Meeting the needs of improving wildlife habitat and promoting sustainable ecosystems will provide timber products to the public over the next few years as a by-product. General guidance in the RLRMP directs the Forest Service to protect and improve renewable resource quality while maximizing net public benefits. Specific direction contained in the RLRMP guides the Forest Service to “Provide a non-declining yield of forest products consistent with land capability, sustainability, protection needs and other resource values.” (RLRMP, pp 2-27)

### **Alternative 2 (Selected Action):**

This selected action will meet the purpose and need and includes several vegetation/habitat management actions. The following activities will be implemented:

- Pine Seedtree on approximately 45 acres in 2 stands.
- Pine Thinning on approximately 2,580 acres in 59 stands.
- Hardwood Shelterwood with Reserves on approximately 52 acres in 2 stands.
- Hardwood Thinning on approximately 282 acres in 8 stands.
- Non-native invasive species (NNIS) treatments will occur throughout project area with herbicide/handtools & burning.
- Hazardous fuel reduction on 12,707 acres of public land and as much as 4,401 acres of private land (with landowner agreement).
- Road maintenance of 33.6 miles, road reconstruction of 8.8 miles, decommissioning of approximately 18.6 miles, 4.4 miles of temporary roading, and installation of up to 12 gate.

Table 2 illustrates the mileage of road work that will be implemented in the Brushy Mountain project area. It was determined after further fieldwork that the miles for each road project will be slightly reduced.

**Table 2. Comparison of Proposals**

<b>Activity</b>	<b>Scoping (Proposed Action)</b>	<b>Actual (Alternative 2)</b>
Temporary Roding	7 miles	4.4 miles
Road Reconstruction	10 miles	8.8 miles
Road Decommissioning	19 miles	18.6 miles
Road Maintenance	35 miles	33.6 miles
Gate Installation	12	12

## **Decision Framework**

Given the purpose and need, the deciding official reviews the proposed action and the other alternatives in order to make the following decisions:

- Which alternative best meets the purpose of this initiative; that is, to guide this project area toward the goals and desired future conditions set forth in the RLRMP.
- Which alternative best meets the purpose of the initiative while producing the least adverse cumulative environmental effects.
- Which alternative best meets the six strategic goals of the Forest Service's 2005-2012 National Strategic Plan.
- Which alternative best meets legitimate concerns from the public.

## **Public Involvement**

The proposal was listed in the Schedule of Proposed Actions in February 2016 until present. It was provided to the public and other agencies for pre-scoping comments and during the official 30-day scoping (comment) period beginning February 29, 2016 through mail outs and the Forest Service website. Five comments were received; however no significant issues or concerns were identified for the Brushy Mountain project area.

## **Issues Eliminated From Detailed Study**

No significant issues or concerns were brought forward from the public during the 30-day scoping period and no comments were received during the 30-day comment period for the Draft EA.

All actions within this EA meet all conditions of the RLRMP and Amendments and other applicable State and Federal Laws and Regulations.

## **Part 2 - Comparison of Alternatives**

This chapter describes and compares the alternatives considered for the Brushy Mountain project. It includes a description of the no action alternative and the selected action. This section also presents the alternatives in comparison form, sharply defining the differences between them and providing a clear basis for choice by the decision maker and the public. Some of the information used to compare the alternatives can be based on the extent of the alternative (for example, the acreage of prescribed burning) and some of the information is based upon the environmental, social and economic effects of implementing the alternative (for example, the amount of erosion or the degree of risk to public safety).

### **Alternatives**

#### **ALTERNATIVE 1**

##### **No Action**

Under the no action alternative, current management plans will continue to guide administration of the project area. Custodial administration will proceed; however, in-

depth, substantive resource management will not be accomplished with the following consequences:

- Early-seral habitat will decline.
- In all likelihood, Oak Decline (insect & disease) symptoms will continue unchecked for the foreseeable future.
- Reintroduction of fire disturbance regimes into fire-adapted ecosystems will not occur.
- The forest will continue to age, which may further exacerbate conditions favorable to insect and disease occurrences. A well-distributed mix of age-classes across the landscape will not be achieved.
- Vegetative diversity and quality wildlife browse will suffer due to more closed-canopy conditions. Loss of grasses and forbs will reduce populations of small mammals, insect/seed-eating birds, and larger game animals such as turkey and deer.
- Critical levels of fuel such as leaf litter, needle-duff layers, and fallen timber will continue to accumulate, increasing the threat of destructive wildfire occurrence.
- Wood products and revenue that help sustain the local economy will not be generated.
- Air quality will remain good; water quality could potentially decrease as natural sedimentation of unstable roads will continue to occur through bank/sheet erosion during heavy rain events.
- Recreation opportunities will remain enjoyable, although visual penetration into the forest by recreational motorists may decline, especially during the summer. Hunting may be negatively impacted as well as observing wildlife due to closed-canopy conditions.
- Opportunities to upgrade and stabilize the transportation system within the project area will be prolonged.
- Unstable roads will continue to contribute sediment to water sources.
- Threatened and endangered species that depend on disturbance (e.g., fire) may decrease.
- Game species populations will decrease.
- Oak and pine timber types will decrease over time.

## **ALTERNATIVE 2 (SELECTED ACTION)**

**Pine Seedtree** – This will occur on 2 mature stands totaling approximately 45 acres. This type of regeneration harvest will remove 90% of the overstory (10-20ft<sup>2</sup>/ac.). Site preparation will be done with handtool/herbicide treatments followed by a prescribed burn in order to prepare a proper seed bed. Natural and artificial regeneration will occur to re-stock the stands with an average 300 trees/acre. Following the establishment of the regenerated stand, release treatments with handtools/herbicide may be needed to promote “free-to-grow” conditions. Once the new stand has been formed, the remaining mature overstory trees will be harvested.

**Pine Thinning** – This will occur on approximately 2,580 acres. Thinning will increase growth of residual trees, reduce susceptibility of the stand to insects and disease, and improve wildlife habitat. The stands will be thinned to an average basal area of 60-80 ft<sup>2</sup>/acre. Trees that are suppressed or display poor form will be removed. Large trees of good form and/or close to the correct spacing will be favored as leave trees. The target spacing of trees will depend on average tree diameter of the stand. Prescribed burning followed by thinning will provide beneficial effects for wildlife. Timber stand improvement (TSI) treatments of the midstory using herbicide and/or handtools may be utilized to further reduce competition and increase sunlight to developing regeneration.

**Hardwood Shelterwood with Reserves** – This will occur on approximately 52 acres (two mature forest stands). This treatment will encourage long-term forest health, provide for the succession of early-seral habitat, and contribute to providing a sustainable forest. The objective of a shelterwood is to open up the stand allowing sunlight to reach the forest floor while leaving an adequate amount of trees to provide seed. As the name implies, several trees will be left in the overstory to give shelter to the developing seedlings on the ground. An average basal area of 20-40 ft<sup>2</sup> will be retained. With Reserves means the mature hardwood left over from the harvests will remain until the new stands receive their first thinning. The combination of stump/root sprouts from oak species and the other existing desirable seedlings will establish the new stands; hand-planting of oak seedlings may also occur.

Following harvest, these stands will have handtools/herbicide applied to undesirable stems, then burned to prepare the site for natural/artificial regeneration. Needed release treatments by either handtools and/or herbicide 1-5 years after seedling establishment will also take place

**Hardwood Thinning** – This thinning will occur in 8 stands, totaling approximately 282 acres. This treatment will increase growth of residual trees, reduce susceptibility of the stand to insects and disease, and improve wildlife habitat. The stands will be thinned to a target basal area of 55-70 ft<sup>2</sup>/acre. Trees that are suppressed or possess poor form will be removed. Trees of good form and/or close to the correct spacing will be favored. The target spacing of trees will depend on average tree diameter of the stand. Prescribed burning followed by thinning will provide benefits for wildlife. TSI treatments of the midstory using herbicide and/or handtools may be utilized to further reduce competition.

**Salvage of Dead, Down, and /or Damaged Timber:** The Pleasant Hill Ranger District is susceptible to natural occurrences such as severe drought, wildfire, tornadoes, windstorms,



lightning strikes, insect and disease outbreaks, catastrophic ice storms, natural mortality, and human-caused events such as arson and residual material from implemented management activities (i.e. ponds, midstory reduction, thinning, and prescribed burning). These occurrences cause hazards for the public and have negative effects on the overall health of the forest. This action will allow the District Ranger to respond to situations within the Brushy Mountain project boundaries where dead, down or damaged trees pose a threat to the public or the health and well-being of the forest in a consistent and timely manner. If the District waits until an incident occurs before making the decision to remove the dead, down or damaged trees through a salvage or firewood sale, a time lag of several months or more could pass before the decision will be implemented. In many cases this time delay is unacceptable because of hazards to the public and/or it could cause the value of the timber product to degrade significantly due to insect and fungal infestations of damaged trees.

Prior to conducting salvage and/or regeneration operations within the Brushy Mountain project area boundaries, site-specific documentation for each salvage and regeneration action will be prepared and retained by the District. As a minimum, that documentation will have a statement of heritage resource survey requirements and clearance type (categorical exclusion or project notification, or other written agreement between the Arkansas State Historic Preservation Office, affected Native American Tribes, and the OSFNFs stand prescription cards with details of the current stand and a regeneration plan to return the affected area back to its desired future condition as well as a statement of effects on proposed, endangered, threatened, or sensitive species (PETS). Documentation will include the location (compartment and stand), estimated area affected (acreage), a map of the impacted area(s), an estimated volume of timber to be removed, identification of the watershed containing the affected area, and identification of the management area within which the affected area lies and actions to be conducted. Each salvage site will be reviewed by an interdisciplinary team and meet all legal requirements prior to commencement of salvage operations. Salvage and/or regeneration operations will be conducted within the project area boundaries following the guidelines from the RLRMP.

### **Wildlife & Fishery Habitat Improvement**

**Wildlife Opening Construction (New)** – Ten new wildlife openings will be constructed. Some of these are linear openings which are utility corridors. Other openings will be constructed in areas where timber harvest occurs. Two existing openings will be increased in size. The total acreage for all wildlife openings will be approximately 19 acres. Stumps, remnant trees and logging debris will be cleared from opening locations with heavy equipment. Openings will then be disked and seeded with cool season or warm season herbaceous species to provide early seral forage for wildlife. Openings will be fertilized and limed and maintained periodically by the use of herbicide application, mowing, disking, seeding, fertilizing, and liming.

**Table 3. Location and Acreage of Wildlife Openings (New)**

COMP/STAND	ACRES OF TREATMENT	COMMENTS
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**Table 3. Location and Acreage of Wildlife Openings (New) (cont'd)**

413/1A	1.5	Construct w/ dozer, disk, seed, fertilize, lime (w/ annual maintenance of mowing and/or herbicide)
413/1B	1.6	
413/1C	1.5	
412/11	1.5	
413/3	1.0	
415/7	2.0	
416/27	4.5	
416/24A	0.7	Linear openings are on utility right of ways (annual maintenance after construction including mowing & herbicide)
416/24B	0.5	
414/2	2.0	
412/20	1.0	Addition to existing opening (0.9 ac.. existing) – annual maintenance after construction including mowing & herbicide
415/33	0.9	Addition to existing opening (1.2 ac. Existing in 415/18) – annual maintenance after construction including mowing & herbicide

**Existing Wildlife Openings (Reconstruction)** – Twenty-two existing wildlife openings comprising approximately 41 acres will have various levels of reconstruction completed on them. Encroaching hardwood, cedar, and pine trees will be removed from inside and around the perimeters of the openings with heavy equipment. Disking, seeding, fertilization, liming, and herbicide application will be utilized to improve these openings and provide early seral cool season habitat for wildlife.

**Table 4. Existing Wildlife Openings (Reconstruction)**

COMP/STAND	ACREAGE	COMMENTS
414/3	1.1	Remove encroaching trees w/ dozer, disk, seed, fertilize, lime – and annual maintenance w/ mowing and/or herbicide
414/4A	1.8	
414/4B	1.6	
414/8	1.3	

**Table 4. Existing Wildlife Openings (Reconstruction) (cont'd)**

414/10	1.4	
414/17	2.1	
414/18	2.6	
415/7	2.0	
415/18A	2.3	
415/18B	1.2	
415/23	0.9	
416/3	1.8	
417/2A	2.3	
417/2B	1.4	
417/13	2.1	
417/15	1.6	
417/18	3.0	
417/28	2.8	
418/5	0.7	
418/29	2.4	
418/32	2.1	
418/38	2.6	

**Gates** – Twelve gates and/or gates in combination with fences will be constructed at the locations of new wildlife openings constructed under the selected action. All of the gates will be placed on access driveways to wildlife openings. Gates will provide seclusion to wildlife openings, prevent damage to openings from vehicles and provide for increased hunter experience and success. Forest Service (FS) road 94418D will be decommissioned and will be the only system road in this project area in which a gate will be installed.

An existing gate is located in Compartment 417 used to protect a wildlife opening from resource damage. This gate will remain closed during most of the year, however, during the modern gun deer season the gate could be opened to allow hunters better access to the area.

Additionally there is an existing gate located on the Devils Ridge Road that protects 7 wildlife openings from resource damage. The gate is not functional as it is in bad shape and being driven around. This gate will be replaced to ensure it functions properly.

**Table 5. Gate Installation Location**

COMP./STAND/ROAD NUMBER	COMMENTS
416/27	
416/2	
413/1	
413/3	
412/11	
415/7	
418/39	No veg. mgt proposed in stand; blocks WL opening
418/27	No veg. mgt proposed in stand; proposed decomm.
416/23A	

**Table 5. Gate Installation Location (cont'd)**

416/23B	
416/23C	
416/23D	

**Wildlife Habitat Improvement Prescribed Fire** – Approximately 4,162 acres of prescribed burning to improve wildlife habitat will occur. This treatment will benefit TES plant and animal species, improve woodland conditions and plant diversity, improve habitat for game species (white-tailed deer and turkey) and neotropical migratory birds and resident birds which are disturbance dependent. All wildlife stand improvement (WSI) and glade restoration areas are located within these burn units. Burn units primarily utilize natural barriers and roads for control lines, and will require minimal fire line construction.

**Table 6. Prescribed Burning (Wildlife)**

COMPARTMENT	ACRES
417	2,100
413	1,100
414	888
418	74
<b>TOTAL</b>	<b>4,162</b>

**Wildlife Stand Improvement (WSI)** – Approximately 318 acres of WSI will occur. This treatment will be utilized to restore open woodland conditions to low quality timber areas. Selective herbicide application, chainsaw felling and or mechanical means will be used to reduce basal area to approximately 50 ft<sup>2</sup>/acre. This will allow for greater light penetration to the forest floor and provide increases in herbaceous species diversity and abundance. Game species such as white-tailed deer and turkey will benefit. Disturbance dependent neo-tropical migratory birds will benefit. TES bat species will benefit from habitat improvement. Rare plants such as small-headed pipewort will benefit.

**Table 7. Wildlife Stand Improvement Location**

COMPARTMENT/STAND	ACRES
414/4	55
413/5	28
413/4	16
413/12	53
414/20	22
415/25	33
415/18	70
418/34	41
<b>TOTAL</b>	<b>318</b>

**Glade Restoration** – Approximately 4 acres of glade restoration will occur. This treatment will remove encroaching hardwood, cedar and pine trees from a glade which contains small-headed pipewort which is a Forest Service Region 8 sensitive plant species (rare plant). This work will be accomplished by selective herbicide application, chainsaw felling and or mechanical means.

**Table 8. Glade Restoration Location**

COMPARTMENT/STAND	ACRES
413/14	4
<b>TOTAL</b>	<b>4</b>

**Large Woody Debris (LWD) in Stream Channels** – Large woody debris will be placed within approximately 9.4 miles of stream channels within the project area. Larger diameter trees will be felled with chainsaws into stream channels to improve fish habitat, increase pool formation in stream channels and assist with bank stability.

**Table 9. Large Woody Debris (Streams) Location**

MILES OF LWD PLACEMENT	LOCATION
2.4	West Prong Barron Creek
2.1	East Prong Barron Creek
0.9	Barron Creek
1.5	Devils Ridge Hollow
1.1	Morgan Cemetery
0.7	Redding Road
0.7	Devils Den

**Non-Native Invasive Species (NNIS)** – The occurrences of Tree of Heaven, and invasive tree species, will be treated with herbicide under an existing National Environmental Policy Act (NEPA) EA and decision record (DN). This decision was signed by the District Ranger in 2009, and allows the use of approved herbicides district-wide to control infestations of NNIS.

The following table shows the forest vegetation management by stand.

**Table 10. Alternative 2 - Forest Vegetation Management by Stand**

Treatment	Compt.	Stand	Acres	Connected Actions
Pine Thinning				Midstory control (TSI) with herbicide/handtools; WL Burn
	411	1, 6, 7, 15, 21	225	
	412	3, 7, 10, 11, 12, 13, 25	293	
	413	1, 2, 3, 6, 10	583	
	414	1, 7, 11-17, 22, 24, 29	342	
	415	7, 19-21, 33	322	
	416	2, 6, 8, 13, 14, 23, 25, 27, 45	275	
	417	1, 7, 16, 17, 23, 26	293	
	418	8, 23, 25, 27, 29, 31, 38, 43	126	
	444	2	34	
	445	19	86	
<b>TOTAL</b>		<b>59 stands</b>	<b>2,580 acres</b>	
Pine Seedtree				Site prep: handtl/herb/mech, burn, release 2-5 yrs after
	416	37	38	
	418	41	7	
<b>TOTAL</b>		<b>2 stands</b>	<b>45 acres</b>	
Hardwood Thinning				Midstory control (TSI) w/ herbicide/handtools; WL Burn
	411	8	42	
	412	18, 24	122	
	415	35	18	

**Table 10. Alternative 2 – Forest Vegetation Management by Stand (cont'd.)**

	416	34, 42, 43	58	
	417	12	42	
<b>TOTAL</b>		<b>8 stands</b>	<b>282 acres</b>	
Hardwood Shelterwood				Site prep: handtl/herb/mech, burn release 2-5 yrs after
	412	15	22	“
	416	10	30	
<b>TOTAL</b>		<b>2 stands</b>	<b>52 acres</b>	

### **Prescribed Fire and Mechanical Fuels Reduction**

#### **Prescribed Fire**

All Forest Service land within the Brushy Mountain project area (12,707 acres) will potentially receive low to moderate intensity prescribed burns to reduce hazardous fuels and wildfire risk, improve wildlife habitat, and for silviculture purposes. Special attention will be given to all pine stands in which only low-intensity burning will take place in order to promote pine regeneration. Knutson-Vandenberg (KV) retained receipt funded prescribed fire will be implemented on all acres possible within KV sale area boundaries surrounding pine thinning units.

Prescribed fire treatments may occur on private lands located within the Brushy Mountain project areas (approx. 4,401 acres), but **only** after consultation with landowners and a prescribed fire agreement under the Wyden Amendment (Section 334(a) of Public Law 105-83) and/or Stevens agreements in cooperation with the Arkansas Forestry Commission. Should agreements with private landowners be signed, private lands will be burned by the Arkansas Forestry Commission under prescription in conjunction with prescribed burns on public lands. Prescribed fire will be utilized for several purposes in the project areas.

Prescribed fire will serve to re-introduce fire into a fire-adapted ecosystem, promote oak and pine regeneration in canopy openings created by red oak borer damage/oak decline, promote regeneration in shelterwood and seedtree harvest areas, maintain pine/hardwood stands in open conditions, increase herbaceous understory species density and diversity, improve habitat conditions for fire-dependent special-status plants, increase soft-mast production and reduce potentially hazardous accumulations of fuels on the forest floor, and improve wildlife habitat conditions. If Rx burning is not conducive, then mechanical fuel reduction may be applied if sufficient funding is available.

#### **Roadwork**

**Reconstruction:** Approximately 8.8 miles of old, existing roads will be reconstructed. These roads are situated on somewhat stable templates that display signs of age where spots of erosion are occurring and drainage crossings are crumbling. Reconstruction will help stabilize, thereby reducing erosion and sediment from reaching streams

**Maintenance:** Approximately 33.6 miles of open and closed roads will receive maintenance within the project area in order to obtain suitable road conditions for hauling timber. County roads anticipated to be used are regularly maintained by their respective counties, along with Forest Service assistance. Closed roads will temporarily be opened during timber/silvicultural activities and immediately closed again with gates or mounds after all



activities have been completed to reduce erosion caused from vehicle traffic and protect wildlife habitat.

**Decommissioning:** Approximately 18.6 miles of existing roads no longer needed for management or access will be decommissioned within the project area. This entails restoring roads to a more natural state. Activities used to decommission a road will include, but are not limited to the following: re-establishing former drainage patterns, stabilizing slopes, restoring vegetation, blocking the entrance to the road, installing water bars (earthen mounds), and removing culverts. Unnamed and illegally accessed off-highway vehicles (OHV) trails present in the project area may be closed using debris, rocks, earthen mounds, or gates.

**Temporary Roads:** Approximately 4.4 miles of temporary roads will be needed to access timber stands. These roads will be blocked, and then rehabilitated with seeding and/or natural re-vegetation. Temporary roads will not be intended to be included as part of the forest transportation system as they are managed for short-term projects or activities, followed by decommissioning after use.

**Access:** Adjacent landowners whose property blocks access to Federal land will be contacted by the Forest Service. Neighbors of the forest will be asked to consider allowing entrance to these otherwise inaccessible areas for forest management and fire protection.

**Table 11 on the following pages explains the roads management planned in the Brushy Mountain project.**

Table 11. Brushy Mountain Project Roads Management

Road No.	Total Road Miles	Open Miles	Closure for >1Yr. Miles	Existing Road No Treatment	Closure Type	Closure Reason	Decom Miles	Decom Reason	Temp Miles	Const. Miles	Recon. Miles	Maint. Level	Maint. Miles	Remarks / Mgmt Priority
1003N	1.0	1.0										4	1.0	Maintenance
1480	4.7	4.7										3	4.5	Maintenance
1500	10.5	10.5									0.2	3	8.5	Maintenance / Reconstruction
1500A	0.5						0.5	Res. pro				2		Decommission
1500B	3.0	3.0					1.7	Res. pro				2	1.3	Maintenance / Decommission
1504-3	7.3	7.3		0.7								3	6.6	Maintenance / Existing
1504A	1.4	1.4									1.4	2		Reconstruction / Change 94412B to 1500A
1543	1.9	1.9		1.5								2	0.4	Maintenance / Existing
4408	2.0	0.8			Gate (existing)							2	2.0	Maintenance
4409	0.5	0.5										2	0.5	Maintenance / Existing
4410	0.3	0.3										2	0.3	Maintenance
4411	0.8	0.8										2	0.8	Maintenance
4412	0.5	0.5										2	0.5	Maintenance
4419	0.5	0.5		0.5								2		Existing
4443	0.5	0.5										2	0.5	Maintenance
94411A	1.1	1.1		0.8	Mound	Res. pro					0.3	1		Reconstruction / Existing
94411B	0.4						0.4	Res. pro				1		Decommission
94411C	0.3						0.3	Res. pro				1		Decommission
94411D	0.5						0.5	Res. pro				1		Decommission
94411E	0.7			0.5	Mound	Res.pro						1	0.2	Maintenance / Existing
94411F	0.3						0.3	Res. pro				1		Decommission
94411G	0.6						0.6	Res. pro	0.3			1		Temporary / Decommission
94411H	1.0						0.6	Res. pro			0.4	1		Reconstruction / Decommission
94411J	0.7						0.7	Res. pro				1		Decommission
94411K	0.8						0.6	Res. pro				1	0.2	Maintenance / Decommission
94411L	0.7						0.7	Res. pro				1		Decommission
94411N	0.3						0.3	Res. pro				1		Decommission

**Table 11. Brushy Mountain Project Roads Management (cont'd)**

Road No.	Total Road Miles	Open Miles	Closure for >1Yr. Miles	Existing Road No Treatment	Closure Type	Closure Reason	Decom Miles	Decom. Reason	Temp Roads	Const. Miles	Recon. Miles	Maint Level	Maint. Req./Miles	Remarks / Mgmt Priority
94412A	2.0			0.7							0.7	2	0.6	Maintenance / Reconstruction / Existing
94412A-1	0.2						0.2	Res. pro	0.2			1		Temporary / Decommission
94412A-2	0.1								0.1		0.1	1		Temporary / Decommission
94412B	0.4													Change to 1500A
94412C	0.2						0.2		0.2			2		Temporary / Decommission
94413A	1.2	0.7					0.5	Res. pro			0.7	2		Reconstruction / Decommission
94413B	0.6	0.6		0.2							0.4	2		Reconstruction / Decommission
94413C	0.7						0.7	Res. pro	0.7			1		Temporary / Decommission
94414A	1.4	1.1					0.3	Res. pro				2	1.1	Maintenance / Decommission
94414B	1.1						0.3	Res. pro	0.2			2	0.6	Maintenance / Temporary / Decommission
94414C	0.8						0.8	Res. pro	0.8			2		Temporary / Decommission
94414D	1.3						1.3	Res. pro				2		Decommission
94414E	0.2						0.2	Res. pro				2		Decommission
94414F	0.5						0.5	Res. pro				2		Decommission
94414H	0.9			0.5	Mound	Res. pro					0.4	1		Reconstruct / Existing
94414I	0.2						0.2	Res. pro	0.2			1		Temporary / Decommission
94415A	0.7	0.7		0.4								2	0.3	Maintenance / Existing
94415B	0.8	0.8		0.8								2		Existing
94415C	1.5	1.5		1.5								2		Existing
94415D	1.2	1.2		1.2								2		Existing
94415E	1.0	1.0		0.3							0.7	2		Reconstruction / Existing
94416A	0.4						0.4	Res. pro	0.4			1		Temporary / Decommission
94416B	0.2						0.2	Res. pro				1		Decommission
94416C	0.6						0.6	Res. pro	0.6			1		Temporary / Decommission
94416E	0.3				Mound	Res. pro						1	0.3	Pre-Haul Maintenance
94416F	0.5			0.5	Mound	Res. pro						1		Existing
94416G	0.9			0.9	Mound	Res. pro						1		Existing
94416H	0.6										0.6	1		Reconstruction
94417A	0.4	0.4										2	0.4	Maintenance
94417B	1.4	1.4		0.6	Gate (existing)						0.8	2		Reconstruction / Existing

**Table 11. Brushy Mountain Project Roads Management (cont'd)**

Road No.	Total Road Miles	Open Miles	Closure for >1Yr. Miles	Existing Road No Treatment	Closure Type	Closure Reason	Decom Miles	Decom. Reason	Temp Roads	Const. Miles	Recon. Miles	Maint. Level	Maint. Req./Miles	Remarks / Mgmt Priority
94417C	1.1	1.1					0.3	Res. pro			0.8	2		Reconstruction / Decommission
94417D	0.9			0.9								2		Existing
94417E	0.3						0.3	Res. pro	0.3			2		Decommission
94417F	1.0			1.0	Mound	Res. pro						1		Existing
94417G	0.1						0.1	Res. pro	0.1			1		Temporary / Decommission
94418A	1.7			0.8	Mound	Res. Pro					0.5	1	0.4	Maintenance / Reconstruction / Existing
94418B	0.6			0.3	Mound	Res. Pro					0.3	1		Reconstruction / Existing
94418C	1.2	0.6					0.6	Res. pro				2	0.6	Reconstruction / Decommission
94418D	1.3				Gate							1	1.3	Pre-Haul Maintenance
94418E	1.0						1.0	Res. pro				2		Decommission
94418F	0.3				Mound	Res. Pro					0.3	1		Reconstruction
94418G	0.2						0.2	Res. pro	0.2			1		Temporary / Decommission
94418H	0.3				Mound	Res. Pro						1	0.3	Pre-Haul Maintenance
94418I	0.5			0.5	Mound	Res. Pro						1		Existing
94418J	0.5			0.5	Mound	Res. Pro						1		Existing
94418K	0.4			0.4	Mound	Res. Pro						1		Existing
94418L	0.2						0.2	Res. pro				1		Decommission
94418M	1.3			1.3								1		Existing
94418N	0.2										0.2	1		Reconstruction / "Easement Needed"
94418O	0.2						0.2	Res. pro				1		Decommission
94418P	0.3						0.3	Res. pro						Decommission
94444C	0.5						0.5	Res. pro				2		Decommission
94444D	0													Cass Job Corp Area, Do nothing
94445B	1.1	1.1		0.9								2	0.2	Maintenance / Existing

**Table 11. Brushy Mountain Project Roads Management (cont'd)**

94445D	0.2	0.2										2	0.2	Pre-Haul Maintenance
94445E	0.3	0.3		0.3								2		Existing
94445F	0.1			0.1								2		Existing
94445G	1.3						1.3	Res. pro				2		Decommission / (Old Huggins Loop)
94445H	0.4	0.4		0.4								2		Existing / (Huggins Loop C)
94445I	0.1			0.1										Existing
Total							18.6		4.4		8.8		33.6	

## **SPECIAL USES**

### **Historic & Current Conditions**

There have been several special use permits/easements issued in the past within the vicinity of the Brushy Mountain project area. This can be attributed to the large number of private in-holdings within the project area along with the recreational opportunities associated with the Mulberry River.

In providing legal access to private property, permits/easements were authorized to individuals that need “long-term” legal access to their private property utilizing roads across National Forest lands. Some permits were authorized for short periods of time, less than 1 year. These types of temporary permits were authorized to commercially haul timber across National Forest lands from private property. Other types of legal access were granted in the form of “utility” type permits for overhead electric power lines, natural gas “gathering” pipelines, and natural gas well locations.

There are two Department of Transportation Easements and three Special Use Permits consisting of an overhead electric powerline, waterline, and natural gas pipeline within the project area.

No other types of permits or easement proposals are on file at this time. The roadwork plan for the Brushy Mountain project will not affect any current or future permitted uses. However, if after a road closure has occurred and a private landowner determines they are in need of legal access, proper procedures for permitting the access shall be followed.

Easement negotiations are ongoing in order for the Forest Service to gain access to timber stands that were identified for treatment within the project area. The following roads were identified for possible negotiating:

- FDR 94412A – This road will provide access to Compartment 412.
- Unnamed woods road – This short section of road intersects FDR 94412A accessing compartment 412.
- FDR 94418N – This is a short segment that accesses compartment 418.

(Further analysis within the project area may determine that other easements are needed).

Table 12 lists the currently issued special use permits that have been identified within the Brushy Mountain project area.



**Table 12. Special Use Permits**

<b>Auth. ID</b>	<b>Name</b>	<b>Road #</b>	<b>S-T-R</b>
<b>PLE0114 (SUP)</b>	<b>Watalula Water Users Assoc.</b>	<b>Waterline</b>	<b>S-11, 12, 14 T 11N, R 27W S-7, 8 T 11N, R 26W S-11, 12, 14 T 11N, R 27W</b>
<b>PLE0166 (SUP)</b>	<b>Arkansas Valley Electric Coop. Corp.</b>	<b>Overhead Electric Line</b>	<b>Various locations within the project area</b>
<b>PLE0134 (SUP)</b>	<b>XTO Energy</b>	<b>Gas pipeline</b>	<b>S-11, T 11N, R 27W</b>
<b>BOS0100101</b>	<b>AHTD</b>	<b>State Highway</b>	<b>Highway 23 (within project)</b>
<b>PLE100153</b>	<b>AHTD</b>	<b>State Highway</b>	<b>Highway 215 (within project)</b>

Other type uses that could occur within the area and will not be affected by any changes in the road system could include recreation events. These uses will be in agreement with the types of non-commercial uses already occurring in the project area. They will be reviewed on an individual basis as proposals were received.

The Brushy Mountain project area is compatible with the management of special uses in the area. A review of private in-holdings within the project area shows it to be moderate in that the Forest Service could receive additional special use proposals for access in the future. (This is based on the existing private in-holdings within the analysis area).

Special Use Permits for other activities such as commercial logging and recreation events is expected to continue. These uses will be in agreement with the types of occurring commercial and non-commercial uses already in the project area. Any new special use proposals will be reviewed on an individual basis when they are received.

Based on this analysis, there should be no significant direct, indirect, or cumulative effects to human health or the physical environment from the administration of special use permits or the proposed easements acquisitions within the project area.

## **MINERALS**

The majority of federal minerals in the project area have been leased in the past. Currently, many of the 10-year leases have expired, with some leases being held by production. The Federal minerals in the project area could once again be nominated to the Bureau of Land Management (BLM) for leasing by interested parties. Leases that are held by production will continue to be in place as long as natural gas is produced in paying quantities from the associated gas wells. When these wells are exhausted the areas will be reclaimed according to their Surface Use Plan of Operations (SUPO), and all associated production equipment will be removed. There are 13 federal wells that have been plugged and abandoned with full reclamation in the project area. There are 5 private surface wells that have been plugged and abandoned also in the project area. There are 3 actively producing federal

gas wells in the project area that were drilled between 1960 and 1982. Also, there are 5 private surface wells that are also still producing in the project area.

The likelihood of mineral development in these areas is low due to current market conditions in the natural gas plays, and the aging infrastructure of the supporting natural gas distribution infrastructure. If markets were to change, the area could experience a renewed interest in development. This development is not reasonably foreseeable for the next 10-15 years, unless the natural gas market substantially improves. The foreseeable impacts of mineral activities in the project area could be the further reclamation of existing locations and the removal of associated infrastructure. These activities will be monitored and administrated according to SUPO's and Special Use Permits currently in place to hold operator's best management practices as reclamation is completed.

## **FOREST WIDE STANDARDS AND MITIGATION MEASURES**

For each alternative, all applicable standards in the OSFNs RLRMP would be applied. The following standards and guidelines are incorporated by reference in this environmental assessment:

RLRMP – pages 3-1 to 3-21 (Forestwide Standards), page 3-23 (Management Area 1.C), page 3-27 (Management Area 1.H.), page 3-31 (Management Area 2.C), page 3-35 (Management Area 3.C), page 3-35 (Management Area 3.E), and page 3-37 (Management Area 3.I)

Best Management Practices (BMP) Guidelines for Silviculture (Arkansas Forestry Commission) and selected Region 8 Timber Sale AT, BT, and CT Clauses would also apply as standard mitigation measures for all proposed actions.

Appropriate mitigation measures from the Scenery Management Guide – Southern Regional National Forests, April 2008 (USDA 2008) would apply as standard mitigation measures.

Some of the more important of these mitigation measures and standards and guidelines are summarized below along with specific mitigation measures for this project. This list is not all-inclusive. The above documents should be referenced for a complete list.

1. Logging slash would be placed above the ordinary high water mark of any stream (State BMP).
2. Water control structures necessary for the control of surface water movement from soil-disturbing activities will be constructed for temporary use roads, skid trails, and fire lines concurrent with construction operations. (RLRMP, p. 3-1)
3. Use logging systems that meet silvicultural prescription objectives. Use cable-yarding systems on sustained grades above 35%. Limit excavated skid trails to protect other resource values. Separate skid trails by at least 200 feet unless drainage patterns prevent separation. Keep excavated skid trails below 30% grade. (RLRMP, p. 3-1)
4. When artificially regenerating pine, use genetically improved seedlings from selective breeding programs (when available). (RLRMP, p. 3-1)
5. In stands designated for pine management, use silvicultural treatments that allow a

- hardwood component up to 30%. (RLRMP, p. 3-2)
6. In stands designated for hardwood management, use silvicultural treatments that allow a conifer component up to 30%. (RLRMP, p. 3-2)
  7. Prescribed burn plans will identify, as smoke sensitive targets, areas where active eagle nests with eggs or chicks are present. Mitigation will be done to avoid putting heavy accumulations of smoke into those areas. Prescribed burns should not be planned closer than 1,500 feet from active nest sites during nesting season. (RLRMP, p. 3-9)
  8. Sensitive species site records and databases that include the Arkansas Natural Heritage Commission database will be maintained and updated periodically. This information along with other information sources will be used to determine future management decisions. (RLRMP, p. 3-9)
  9. Project specific informal consultation will be done for all activities proposed within primary conservation zones. No disturbance that will result in the potential taking of an Indiana bat will occur.
  10. In the primary conservation zone for the Indiana bat, the following new improvements and treatments are not permitted: permanent road construction, trails, grazing or hay allotments, wildlife openings, special uses, and integrated pest management using biological or species-specific controls. Other activities that create permanent openings are prohibited within the primary conservation zone.
  11. Tree cutting and prescribed fires are prohibited in primary and secondary Indiana bat zones between May 1 and November 30. Adjustments to these dates may be made on a project-specific basis through coordination with the Arkansas Field Office, USFWS. Site-specific inventories are good for two calendar years from the date of survey completion.
  12. In secondary zone buffer around Indiana bat hibernacula, a minimum of 60 percent of all forested acreage is maintained in nine inch or greater size classes. Of this total, about 40 percent will be trees in a mature condition. The 0 to 10 age class does not exceed 10 percent of the forested acreage of the secondary buffer at any time.
  13. In the secondary zone buffer around Indiana bat hibernacula, live trees or snags, buildings, and other structures known to have been used as roosts by Indiana bats are protected from cutting and/or modification until they are no longer suitable as roost trees, unless their cutting or modification is needed to protect public or employee safety. Where roost tree cutting or modification is deemed necessary, it occurs only after consultation with the USFWS.
  14. Tree cutting and salvage operations can occur between December 1 and March 15 without a site-specific inventory. Additional coordination with USFWS is not required. (RLRMP, p. 3-10)
  15. Shagbark hickory, because of its high value as roost/maternity sites, should receive

- special attention during sale layout and cultural treatments. In areas where shagbark hickory is uncommon, retain all shagbark hickory over six inches dbh (6"dbh) except those that are immediate hazards. If multiple 6-inch or greater stems are encountered, which are competing for moisture, nutrients, and growing space, thin to retain the largest shagbark trees with potential for crown development and longevity. Where shagbark hickory is common within the treatment stand and the surrounding landscape, retain the largest individual shagbark stems in the treatment stand as part of the 20 basal area (overstory) and allow smaller stems, which might be in excess of six inches dbh (6"dbh) to be removed during regeneration treatments. (RLRMP, p. 3-10)
16. A 200-ft buffer of undisturbed forest will be maintained around gray bat maternity and hibernation colony sites, Ozark big-eared bat maternity sites, bachelor sites, or winter colony sites. Prohibited activities within this buffer include cutting of overstory vegetation; construction of roads, trails, or wildlife openings or development of pastures; and prescribed burning. Exceptions may be made where coordination with USFWS determines these activities to be compatible with recovery of these species. (RLRMP, p. 3-11)
  17. Promote and implement current Best Management Practices (BMPs) for forestry as recommended by the Arkansas Forestry Commission to all management activities in order to control non-point source pollution and comply with state water quality standards. (RLRMP, p. 3-11)
  18. Concurrent with temporary road re-construction, install silt barriers at the base of the cut and fill slopes within 50 feet of a stream course. (RLRMP, p. 3-11).
  19. At stream crossings, seed and mulch cut and fill slopes within 50 feet slope distance within 5 days after construction of temporary roads (RLRMP, p. 3-11).
  20. Apply gravel at temporary road crossings for 35 feet on both sides of the stream channel, when the risk of soil erosion is present and where the crossing substrate requires hardening. (RLRMP, p. 3-11).
  21. On temporary roads, apply gravel on steep grades exceeding 10% slope. (RLRMP, p. 3-11).
  22. Soil disturbances within streamside management zones (SMZs) would be treated with erosion control measures within 5 days. (RLRMP, p. 3-11).
  23. No mechanical site preparation (excluding mulching) is done on sustained slopes over 35% or on slopes over 20% when soil erosion hazard is classified as "severe."
  24. SMZs would be identified and designated during the appropriate stages of project planning for all defined channels, perennial streams, and springs. Minimum SMZs would be as described in Table 13 based on the percent of the adjacent slope. (RLRMP, p. 3-12):

**Table 13. Minimum SMZ % Comparison**

Stream Type	Slope Adjacent to the Channel		
	0-15%	16-35%	36%+
Description	Horizontal Distance from Both Sides of Stream Bank or Lake/Pond		
Perennial & Springs	100'	125'	150'
Defined Channels	50'	75'	100'

- Vegetation within 20 feet of the bank of a perennial stream and 5 feet of a defined channel would not be removed.
  - Retain at least 50 square feet per acre of basal area within the SMZs when available.
  - No mechanical site preparation is allowed within the SMZs.
  - Within SMZs, only non-motorized trails are allowed. Motorized trails are prohibited except at designated crossings or where the trail location requires some encroachment for safety.
  - No more than five percent of the mineral soil within the SMZs would be exposed during ground disturbing activities.
  - Exceptions to SMZ standards are only allowed after site-specific determinations and with consultation/approval by the appropriate Staff Officer. (LRMP, p. 3-12).
25. On all soils dedicated to growing vegetation, the organic layers, topsoil, and root mat would be left intact over at least 85% of an activity area. (RLRMP, p. 3-12).
26. Removal of natural debris from streams would only be allowed where it poses a significant risk to public safety or threatens private property or Forest Service infrastructure. (RLRMP, p. 3-12)
27. Within the SMZs, cross only at designated crossings identified during planned activities. Cross at a 90-degree angle and utilize temporary structures to maintain bank stability. (RLRMP, p. 3-13)
28. When temporary culverts or other approved structures are used, they must be removed upon completion of the activity. Streamside management zones disturbances would be restored to a stable, natural condition. (RLRMP, p. 3-13)
29. Soil and debris would not be deposited in wetlands, springs, or seeps. (RLRMP, p. 3-13)
30. Any area that meets the riparian area definition (p. 2-71) will be managed as Riparian Corridors MA (3.I). These stands will be mapped and reallocated to Riparian

Corridors MA (3.I) in subsequent RLRMP amendments. (RLRMP, p. 3-13)

31. Best available smoke management practices (FSM 5140, State Smoke Management Plans and State Implementation Plans) will be used to minimize the adverse effects of prescribed burning on public health and safety and to protect visibility in Class 1 Area (Upper Buffalo Wilderness). (RLRMP, p. 3-13)
32. Prescribed burning will be conducted in, or adjacent to, counties with forecasted high Air Quality Index (AQI) values (AQI equals orange or higher) only if meteorological conditions indicate that smoke will be carried away from the AQI area. (RLRMP, p. 3-13)
33. Conduct all National Forest management activities in a manner that does not result in (1) a significant contribution to a violation of National Ambient Air Quality Standards or (2) a violation of applicable provisions in the State Implementation Plan. (RLRMP, p. 3-13)
34. All dispersed and developed recreation management activities will be managed according to Recreation Opportunity Spectrum (ROS) classification.
35. All areas of the OSFNFs except designated open roads (subject to applicable State laws) and trails are closed to OHV use in order to minimize disturbance, environmental damage, and other user conflicts. (RLRMP, p. 3-14)
36. Projects will be designed to meet the assigned scenic integrity objectives (SIO) as defined in Appendix G. (RLRMP, p. 3-14)
37. Where possible, locate log decks and borrow areas out of sight of roads and trails in areas that have high or very high SIOs. (RLRMP, p. 3-14)
38. Coordinate management direction with the State Historic Preservation Office, federally recognized tribes, and other appropriate state and federal agencies pursuant to Programmatic Agreement. (RLRMP, p. 3-16)
39. Close or obliterate all temporary roads. (RLRMP, p. 3-16)
40. Temporary roads should have a grade which does not exceed 20% for lengths more than 200 feet. (RLRMP, p. 3-16)
41. Erosion control will be applied to all newly disturbed road cut and fill embankments before closing roads with native-bed surfaces that exceed a 10% grade. (RLRMP, p. 3-16)
42. The Fire Management Plan (FMP) will guide and formally document the Fire Management Program for the OSFNFs. The FMP will provide comprehensive guidelines for both the suppression and prescribed fire programs in relation to other management activities and resource objectives. (RLRMP, p. 3-20)
43. All prescribed burning will be fully coordinated with all resources and documented in

- silvicultural prescriptions signed by a certified Silviculturist and approved by the District Ranger. (RLRMP, p. 3-20)
44. Except when firefighter safety and/or life and human property are compromised, fire line construction within 20 feet of a perennial stream and five feet of a defined channel will be done using hand tools. (RLRMP, p. 3-20)
  45. Herbicide treatment areas will not be prescribed burned for at least 30 days after application. (RLRMP, p. 3-20)
  46. In any prescribed burning, the duff layer will remain present on 80% of the burn area. (RLRMP, p. 3-20)
  47. Appropriate erosion control strategies will be applied to fire lines in order to minimize soil erosion. (RLRMP, p. 3-20)
  48. If necessary to cross a stream with a fire line, the crossings will be as close to right angles as possible and be stabilized as soon after the fire is controlled as possible. (RLRMP, p. 3-20)
  49. The full range of wildland suppression tactics (from immediate suppression to monitoring) may be used consistent with Forest and resource management objectives and direction. (RLRMP, p. 3-21)
  50. The response to unplanned, natural ignitions may include fire use, which is managing the ignition to accomplish specific resource management objectives in predefined areas as outline in the Fire Management Plan. (RLRMP, p. 3-21)
  51. Management activities are designed to meet or exceed the assigned Scenic Integrity Objectives. (RLRMP, p. 3-27)
  52. Within 300 feet of Scenic Class 1 designated road, the following silvicultural prescriptions are allowed:
    - Group selection in hardwoods
    - Oak woodland prescription
    - Single tree selection
    - Shelterwood with reserves
    - Pine woodland
  53. Vegetation management will be accomplished with management-ignited prescribed fire, wildland fire use, chemical, and mechanical treatments as an appropriate method of reducing costs associated with these activities. (RLRMP, p. 3-27)
  54. No log landings are allowed within 100 feet of riparian corridors. (RLRMP, p. 3-37)
  55. Skid trails must use designated crossing within 100 feet of riparian corridors. (RLRMP, p. 3-37)

56. Logging and roadwork would be restricted during wet soil conditions to minimize resource damage.
57. Protect the visual resource by stand shaping and irregular boundaries in the proposed shelterwood stands as needed to achieve the visual quality objective. Take advantage of any opportunities to leave groups of hardwoods in pine regeneration areas.
58. The State Historic Preservation Officer has reviewed and concurred with mitigation measures and avoidance treatments proposed in the project notification submitted to the State Historic Preservation Office. Sites that are determined eligible for the National Register and sites that have undetermined eligibility would be protected from any ground-disturbing activities associated with this project. Buffers would be painted around these sites, and heavy machinery would not be allowed within these boundaries. If additional sites are found during implementation of this project, they would be examined and necessary mitigation measures prescribed by the Forest Archaeologist would be implemented.

Sites that have been determined not eligible for nomination to the National Register would not be protected unless there is a safety concern or traditional cultural practice associated with the site.

59. A review of listings and locations of all known occurrences of proposed, endangered, threatened, or sensitive species (PETS) has been conducted. In addition, field surveys have been made on all stands to be impacted by each of the action alternatives. No critical or essential habitat for any PETS species was identified in these compartments. If any additional PETS species are discovered prior to or during implementation, the project would be halted and a new biological evaluation would be made to determine the effects on the species and its habitat. A Biological Evaluation was prepared for this project and is part of the process file.

Timber harvest activities would leave, on average, a minimum of six roost trees, snags, or potential roost trees per acre as per the 1998 U.S. Fish and Wildlife Service Biological Opinion for the Indiana Bat (U.S. Fish and Wildlife Service, 1998).

If Ozark chinquapin were located in a stand to be treated with herbicide, the trees would be placed in a 60-foot buffer, inside which no treatment with herbicides or handtools would occur.

60. In pine stands mast producing trees 10.0" diameter or larger at 4.5' height above ground level would not be treated during site preparation unless otherwise approved by a Wildlife Biologist or Technician.
61. The Ozark National Forest will locate road, skid road, and skid trail crossings to minimize impact to the trail corridor and other resources. Where the trail is located on an existing road or is on the only feasible location for a road needed to access NF lands, the Forest may relocate short segments of the trail or a road after interdisciplinary review with public input in advance of construction.



62. Require mitigation measures including screening, feathering, and other visual management techniques to mitigate visual and other impacts of new or upgraded utility rights-of-way. Mitigation measures apply to facilities as well as vegetation.

### **HERBICIDES (Alternative 2)**

63. During site preparation, release, and pre-commercial thinning in all alternatives, treatments with handtools and/or herbicide would not be done within 100 feet of private land.
64. Herbicides and application methods are chosen to minimize risk to human and wildlife health and the environment. Diesel oil would not be used as a carrier for herbicides, except as it may be a component of a formulated product when purchased from the manufacturer. Vegetable oils would be used as a carrier for herbicides when available and compatible with the application proposed. (RLRMP, p. 3-4).
65. Herbicides are applied at the lowest rate effective in meeting project objectives and according to guidelines for protecting human and wildlife health. Application rate and work time must not exceed levels that pose an unacceptable level of risk to human or wildlife health. If the rate or exposure time being evaluated causes the Margin of Safety or the Hazard Quotient computed for a proposed treatment to fail to achieve the current Forest Service Region 8 Standard for Acceptability (acceptability requires a MOS > 100 or, using the SERA Risk Assessments found on the Forest Service website, a HQ of < 1.0), additional risk management must be undertaken to reduce unacceptable risks to acceptable levels or an alternative method of treatment must be used. (RLRMP, p. 3-4).
66. Fuelwood sales would not be made for a minimum of 30 days after treatment in areas where pesticide treatments have been made. Should injection of trees be done, effected trees would not be sold as fuelwood. (RLRMP, p. 3-4).
67. Weather is monitored and the project is suspended if temperature, humidity, and/or wind meet the criteria shown below in Table 14. (RLRMP, p. 3-4).

**Table 14. Comparison of Project Weather Monitoring**

Application Techniques	Temperatures Higher Than	Humidity Less Than	Wind (at Target) Greater Than
Ground			
Hand (cut surface)	NA	NA	NA
Hand (other)	98°	20%	15 mph
Mechanical (liquid)	95°	30%	10 mph
Mechanical (granular)	NA	NA	10 mph

68. Each Contracting Officer's Representative (COR), who must ensure compliance on contracted herbicide projects, is a certified pesticide applicator. (RLRMP, p. 3-5).
69. A certified pesticide applicator supervises each Forest Service application crew and trains crew members in personal safety, proper handling in application of herbicides, and proper disposal of empty containers. (RLRMP, p. 3-5).

70. With the exception of treatment by permittees of right-of-way corridors that are continuous into or out of private lands and through Forest Service managed areas, no herbicide is broadcast within 100 feet of private land or 300 feet of a private residence unless the landowner agrees to closer treatment. Buffers are clearly marked before treatment so applicators can easily see and avoid them. (RLRMP, p. 3-5).
71. Application equipment, empty herbicide containers, clothes worn during treatment, and skin are not cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate labeled containers. (RLRMP, p. 3-5).
72. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas. (RLRMP, p. 3-5).
73. Herbicide would not be used within the appropriate SMZs or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a "Finding of No Significant Impact" (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas. (RLRMP, p. 3-5)
74. The risk of herbicide spills would be reduced by securing containers during transport, carrying only enough for a day's work, mixing and cleaning on the work site, proper disposal of containers and preparation of an emergency spill plan (USDA. FS 1981). This spill plan is part of the process file.
75. Edible berries would not be treated with herbicide.
76. Herbicide application would be suspended by the COR or inspector if rainfall is heavy enough to cause movement of herbicide from target species.
77. Notice signs will be clearly posted on herbicide-treated areas.
78. Herbicides will not be applied within 60 feet of any threatened, endangered, proposed, or sensitive plant. However, after site-specific analysis, the district biologist can prescribe mitigation measures which allow treatment within this zone. Buffers are clearly marked before treatment, so that applicators can easily see and avoid them.
79. Accident preplanning will be done, and emergency spill plans (FSM 2109.12, chapter 30) will be prepared.

Additional mitigation measures for Integrated Pest Management adhered to by the U.S. Forest Service are listed in the RLRMP pages 3-4, and 3-5.

## **MONITORING**

All activities will be monitored to ensure mitigation measures are applied.

- a. Survival checks will be done to determine the effectiveness of reforestation activities and ensure that the stands have been re-established.
- b. Herbicide off-site movement will be monitored on the district. Samples on a percentage of the areas will be taken before, during, and after herbicide applications. They will be analyzed by a certified testing laboratory.
- c. Applicable RLRMP monitoring and evaluation requirements will be implemented as directed within budgetary limitations. These requirements include measures to monitor current and past activities in terms and implementation, effectiveness, and validation monitoring levels.

### **Part 3 – Environmental Consequences**

This section summarizes the physical, biological, social, and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in Table 15.

**Table 15. Comparison of Alternatives' Effects.**

	<b>Alternative 1</b>	<b>Alternative 2</b>
<b>Soil Resources</b>	Natural erosion continues; unmaintained roads continue to erode	Total expected temporary reduction of soil productivity would be 231 acres (13% of the harvested area).
<b>Water Resources</b>	Disrepaired roads contribute to stream sediment; 217 % increase Concern level = low for Clear Creek-Mulberry River	218% increase in sediment within the 6 <sup>th</sup> level watershed; concern level = low
	215% increase Concern level = low for Mountain Creek-Mulberry River	206% increase in sediment within the 6 <sup>th</sup> level watershed; concern level = low
	430% increase Concern level = low for Spirits Creek-Mulberry River	434% increase in sediment within the 6 <sup>th</sup> level watershed; concern level = low
	522% increase Concern level = moderate for North Fork-White Oak Creek	513% increase in sediment within the 6 <sup>th</sup> level watershed; concern level = moderate
<b>Air Resources</b>	No change from current conditions	Short term direct effects include: Daily (~3800 ac.) emission volumes: 13,042 tons of CO <sub>2</sub> ; 522 tons of particulate matter

**Table 15. Comparison of Alternatives' Effects (cont'd)**

<b>Road Access</b>	Approximately 98 miles of roads in and around the project area.	35 miles of maintenance, 9 miles of reconstruction, 19 miles of road decommission, 7 miles temporary.
<b>Vegetation Resources</b>	As forest ages, it will become more vulnerable to outside elements; decrease in early-seral veg. = decrease in biodiversity	Thinning= 2,862 acres; Hardwood shelterwood = 52 acres; Pine Seedtree= 45 acres; indirect/cumulative effects = increase in biodiversity, more benefits to oak regen. from Rx fire
<b>Wetlands &amp; Riparian Areas</b>	No change from current conditions	With road decommissioning, maintenance, and reconstruction, water quality would improve
<b>Heritage Resources</b>	Previously recorded sites will continue to deteriorate; no additional surveys would be conducted; no sites would be addressed for their National Register of Historic Places Eligibility	39 known sites, 11 of them are recommended eligible for listing in the National Register of Historic Places; more sites may yet be found. If prescribed mitigation measures are properly implemented, project activities would not be expected to adversely affect cultural resources. Implementation of project activities would be expected to benefit cultural resources over time by increasing opportunities for monitoring sites.
<b>Wildlife Resources</b>	Increase in early successional habitat would not occur. Negative indirect impacts to wildlife species. No benefits from Rx burning	Thinning would yield positive indirect impacts to wildlife, increased abundance of soft mast species; increased wildlife benefits from increased Rx fire, increased positive indirect impacts to hardmast producing species and herbaceous vegetation.
<b>TES</b>	Detrimental effects to species needing open habitats.	Benefit to species which require open and/or fire-dependent habitats; implementation of this proposed project may benefit Ozark big-eared bat, Gray bat, Indiana bat, and Northern long-eared bat by providing habitat improvement.
<b>Human Health</b>	Potential effects of injury and damage to personal property in oak decline areas remain; mainly on travelways and camping/hunting sites. Risk to private property and safety is higher due to higher hazardous fuels accumulations	Risks of injury/damage to personal property in oak decline areas reduced; risk of worker injury rises due to timber harvest, TSI, and burning; risks of smoke effects to neighbors increases
<b>Social &amp; Economic Factors</b>	There would be no economic benefits to the local communities resulting from jobs created by timber sales or money to be used for wildlife habitat needs (KV money).	Activities proposed would affect the local economy by supplying timber for local mills, employing loggers to harvest timber, employing people to do site preparation, release, and wildlife habitat improvement work. Revenue generated for roads/schools
<b>Recreation</b>	This alternative will not change the recreation use (OHV driving, camping, hiking, mountain bicycling, or fishing) in the project vicinity.	Short-term browning of vegetation from herbicide use and burning would occur. More visually-penetrating views into forest for motorists... more occasions for wildlife viewing.

## **1. Water Resources**

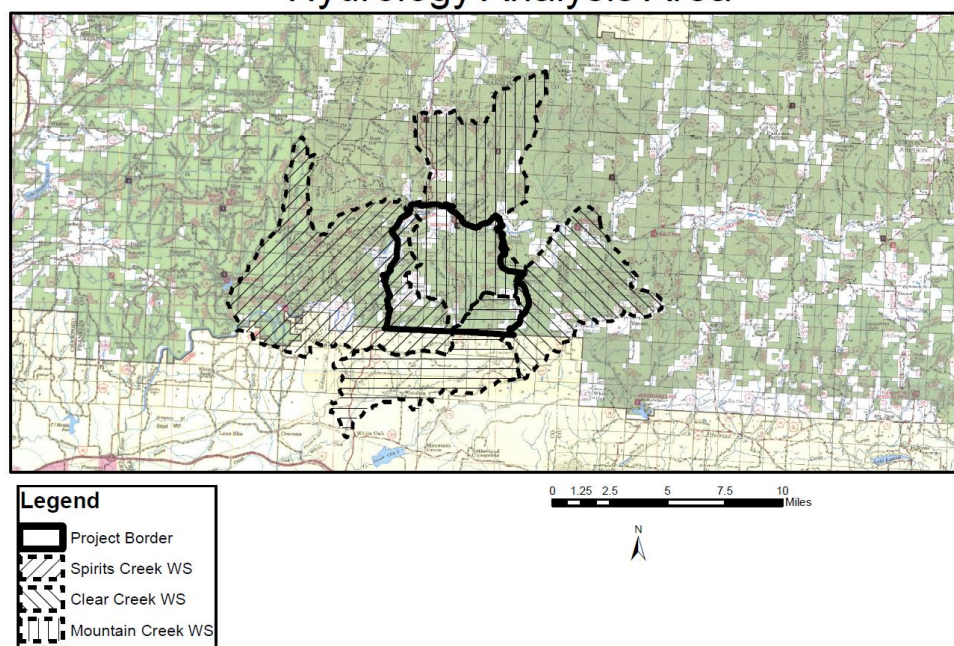
### **Existing Condition**

Watersheds in the United States are divided into progressively smaller units known as hydrologic units, recognized by the United States Geological Survey (USGS) - as regions, sub-regions, basin, and sub-basin units. This hierarchical division of watershed boundaries is useful for assigning address-like codes to drainage basins. This project area (Figure 2) falls within the Arkansas-White-Red region (11), the Lower Arkansas sub-region (1111), the Lower Arkansas-Fourche La Fave basin (111102), and the Frog-Mulberry sub-basin unit (11110201). The OSFNF further classify land areas into progressively smaller units: watersheds and sub-watersheds. The proposed project area falls within the Mulberry River (1111020107) and the White Oak Creek (1111020109) watersheds. At the smallest scale, the proposed project activities occupies portions of four sub-watersheds as listed in the table below. These sub-watersheds, or 6<sup>th</sup> level Hydrologic Unit Code (referred to as a watershed), will serve as the analysis boundary for the proposed project with respect to water resources. The project area as discussed in this section of the document will consist of the compartment boundaries where activities will occur.

**Table 16. Sub-Watersheds of Project**

Watershed Number	Watershed Name	Total Acreage	Project Area Acreage Included
111102010701	Clear Creek-Mulberry River	15,054	350
111102010703	Mountain Creek-Mulberry River	25,094	10,076
111102010706	Spirits Creek-Mulberry River	30,964	4,265
111102010902	North Fork-White Oak Creek	13,896	2,310

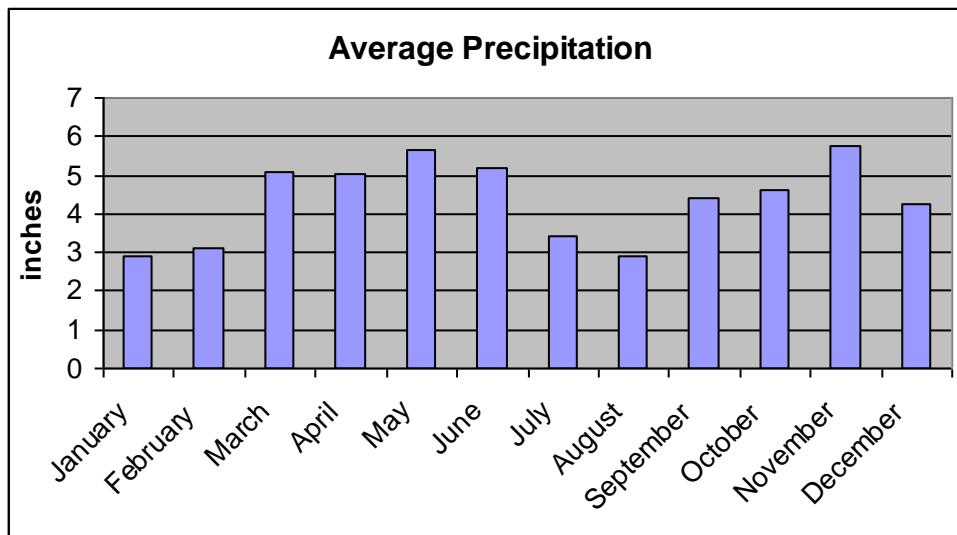
## Hydrology Analysis Area



**Figure 2. Project area watersheds**

The project area and the sub-watershed analysis area support streams and rivers that have a dendritic drainage pattern. Dendritic drainage patterns typically have branching tributaries, which can concentrate precipitation across a wide area into one main stream channel. The primary streams that are found in the project area are: Rock Creek, East and West Prongs of Barron Creek, Oak Creek, John Turner Creek, and the Mulberry River, along with several unnamed tributaries. The creeks and tributaries generally flow north or west and join the Mulberry River which is a designated Wild and Scenic River. The Mulberry River then flows southwest until it joins the Arkansas River.

The project area geology consists of Pennsylvanian-age clastic sedimentary rocks of the Atoka formation (McFarland 2004). This formation is predominantly composed of alternating sandstone and shale layers. Furthermore, the formation's structure and bulk characteristics do not support particularly good aquifers; in fact, the shale layers act as aquicludes preventing deep-seated infiltration. Therefore, the base flow contributions necessary to maintain perennial streams are highly variable and associated with seasonal climatic precipitation variation and shallow soil properties.



**Figure 3. Comparison of Average Precipitation/Month**

Climate information obtained for the project area was derived from information for the town of Ozone, AR (NRCS-Climate Product). The bars on Figure 3 indicates average precipitation over a 30-year data period or climatic norm. Mid-winter and late summer is found to be the driest portions of the year; this suggests that stream flow will most likely be the lowest during the late summer.

Research conducted by Rogerson and Lawson (1982) on the hydrological characteristics of mixed hardwood watersheds in the Boston Mountains, reveals some important traits for runoff and stream flows within small ephemeral streams of this area. Runoff should be expected to occur every month except for the driest summer months, and the precipitation required to initiate channel flow is between 12-40 mm (.47-1.5 in). Very large discharges, termed by the authors as those above  $.1\text{m}^3/\text{s}$ , occurred 1.25 times per year and were initiated by precipitation in excess of 75 mm (2.9 in.) on very saturated soils. Soil moisture maintained consistent levels during the vegetation dormant season and correlated with the majority of the runoff periods during this study. During the vegetation growing season, soil moisture levels were found to dramatically drop due to evapotranspiration, and large summer storms were required to initiate stream flows as a large capacity of soil moisture storage was available for infiltration. Small stream channels known as ephemeral streams and headwater streams commonly carry storm-flows especially during the spring when there is little evapotranspiration and often drenching precipitation. Additional studies by Lawson, (1985) reported that for storm-flow values, the average turbidity from these ephemeral streams over a 5-year period averaged from 19 – 40 Nephelometric Turbidity Units (NTU) in the absence of any vegetation treatment. The authors concluded that as a result of their sampling methodology the results were heavily biased by large turbidity values resulting from a small number of storm flow events. These results are interpreted to indicate that storm flows are initiated by above average rainfall events and on occasion significant precipitation events can drive naturally occurring turbidity values in excess of 19 NTU from ephemeral streams in small undisturbed watersheds.

Within the watershed analysis areas approximately 66% (or 55,881 acres) is administered by the Forest Service. This leaves a sizable area of the land within the watershed as privately owned, roughly 34% (or 29,127 acres). Land use within the analysis area is approximately



94% forested. The balance of the watershed land uses are mainly agricultural type land uses. Other activities occurring within the analysis area include the Spirits Creek project being conducted in the Spirits Creek watershed. This project is located on the Boston Mountain Ranger District and was started in 2014. Activities from the Spirits Creek project have been considered in the cumulative analysis for the Brushy Mountain project.

Forested land uses indicate a stable landscape that results in minimal amounts of natural or background erosion, especially for Arkansas (Miller and Liechty, 2001). For many parts of the OSFNFs, the prevalent soil cover contains many rocks and rock fragments which ultimately limit the erosive susceptibility of the soils. Measured erosion for minimally-disturbed forest lands rarely exceed 0.25 tons per acre where soil erosion from cropland has been estimated at 3.8 tons per acre (Patric, et al. 1984).

There are approximately 836 acres of floodplain within the project area. These mostly occur in narrow strips, mainly along the Mulberry River but there are other small floodplains identified in the project area. There are also approximately 423 miles of Forest Service roads in the analysis area and 98 miles in the project area. This results in a road density of 3.19 miles per square mile for the analysis area and 3.4 miles per square mile for the project area.

The project is located in both the Boston Mountain and Arkansas River Valley ecoregions as identified by the EPA (2003) as a revision of work produced by Omernick (1987). These are the same ecoregion divisions recognized by the state for use in defining water quality standards. Thus, water quality standards for the project area, and the sub-watershed analysis area for this project, are determined by the Arkansas Pollution Control and Ecology Commission Regulation 2 – Water Quality Standards for Surface Water (2014). The designated uses assigned to the surface waters in the project area are as follows: for all waters, secondary contact recreation, domestic, industrial and agricultural water supply, seasonal stream fisheries. For surface water where the watershed is greater than 10 mi<sup>2</sup>, and all lakes and reservoirs, the designated uses are the same as above but include primary contact recreation and the perennial fisheries.

Existing land uses in the region, and their impacts on water quality have been studied by the US Geological Survey's Ozark Plateaus National Water Quality Assessment Program. Trends that show increased nitrogen, phosphorus and coliform bacteria concentrations occur with increases in agricultural and urban land uses (Davis and Bell 1998). Forested land uses have a much lower concentration of these constituents. This data does not isolate the direct or transient effects of timber harvest on nutrients, but it does illustrate the water quality impacts of alternative land uses in the Ozarks and surrounding Arkansas landscapes.

### **Direct and Indirect Effects**

#### **Alternative 1**

Selection of the no action alternative would result in no direct effects because no activities would be conducted for this project. The current trends and conditions are expected to continue. Indirect effects would continue to result from the existing conditions of the project area. The effects of vegetation on water yield within the watershed would continue through evapotranspiration processes. Roads that do not receive necessary maintenance would



continue to pose a chronic threat to water quality as problem erosion areas would continue to exist, or worsen.

Roads are the most common source of accelerated erosion on National Forest lands. Roads generate sediment from the erosion of excavated surfaces, ditches, and road maintenance operations. Raw ditch lines and roadbeds would be a continual source of sediment, usually due to lack of maintenance, inadequate maintenance, excessive ditch line disturbance, or poorly timed maintenance. As a result of this alternative, roads in need of maintenance and reconstruction would not receive the necessary upgrades to minimize resource damage. Unpaved roads paralleling and crossing streams would continue to pose specific risks to water quality as they often maintain linkages with the stream channel.

## **Alternative 2**

The main issue with respect to forest management activities and water quality is effects to water quality that may result from the selected project; changes to water quality should not exceed the standards determined for the identified designated uses. The activities which may elicit direct and indirect effects are those of vegetation management; silvicultural site preparation, reconstruction and decommissioning, and prescribed burning.

In a summary of silviculture activity effects in the Ozark-Ouachita Highlands, Lawson (1985) documented the amount of sediment produced from small watersheds in the undisturbed state and that produced as a result of vegetation management practices. The undisturbed sites produced about 13.8 lbs/acre of sediment with 70% of this amount attributed to large precipitation events. A seed-tree harvest produced more than twice as much sediment, 31.3 lbs/acre during the first year after harvest. Three years after the treatment the erosion rates were similar to those of the undisturbed state. This is roughly equivalent to one half of a 5 gallon bucket of soil. Another study by Lawson and Hileman (1982) investigated the effects of the seed-tree removal and site preparation burning. The results indicated that there were no statistically significant differences in stream turbidity between seed-tree removal sites and undisturbed control sites. Thus, seed-tree silvicultural practices in Arkansas will result in the production of sediment, but at levels below those found on typically managed forest lands of the eastern U.S. Therefore, the vegetation management practices selected for this project will result in temporary increases of sediment but at relatively low levels for a short duration.

Using paired watershed studies for regions of the U.S., effects of silviculture practices on annual average stream discharge was depicted by Stednick (1996). In this study, the actions necessary for producing measurable increases in water yield from forests in Arkansas was determined to be a 50% reduction in basal area across an entire watershed. This level of vegetation harvest will result in an increase of roughly 6 inches above normal runoff values for the first year. The recovery period for water yield to return to pretreatment level was found to be a function of vegetation re-growth. For Arkansas, this means that water yields should return to pretreatment level quite rapidly; however, changes to peak flow and storm flow timing may continue if drainage patterns are altered by activities such as road construction. Any changes to runoff timing should not result in impacts to current water uses or quality. Additional studies in the Missouri Ozarks by Stettergren and Krstansky (1987) indicate that for small watersheds where a regeneration treatment has occurred, slightly higher storm flows and peak discharges have been noticed; however, the absolute amounts of

increased yield were not of notable quantities. This study also noted that the time to peak and total flow duration was unchanged.

The included watersheds are approximately 94% forested but harvest will occur over only 3.5%. The selected action will reduce the basal area by less than 50%, so the harvest is not expected to notably affect water yield.

The addition of LWD to streams in part of the project area will serve to increase the stream roughness coefficient within the channel under normal flow conditions and during high water events. Increasing the roughness slows the water velocity, helping to protect stream banks and flood plains from erosion. A lower velocity also encourages deposition of sediment from the water.

Long-term implications of nutrient loading after timber harvest for streams in the south were described in a study by Lynch and Corbett (1990). In this study, BMPs were used that included 100-foot wide perennial buffers, logging slash removed from streams, sale units monitored by a responsible party, operations ceased during wet weather, roads laid out by a professional, roads did not exceed 10% grade, culverts were used to cross perennial streams and removed when done, water bars utilized, roads gated, and filtration strips maintained. The results indicated that nutrients will not exceed water quality standards and that only during the treatment year would nutrients show a statistically significant increase. An important conclusion was the demonstration of the effectiveness of BMPs for controlling nutrient export.

Forest management options typically include the use of chemical pesticides in the form of herbicides to control unwanted or inappropriate vegetation growth. The use of chemicals may affect stream habitats directly (through acute or chronic toxic effects) or indirectly (as a result of changes to the composition of plant communities). Direct effects depend on two factors, the toxicity of the herbicide and the level of exposure. Toxicity varies among the products used, where common chemicals such as glyphosate are only slightly to non-toxic to aquatic organisms to chemicals such as Triclopyr ester which pose a greater risk to fish and invertebrate toxicity.

Exposure is determined by such conditions as application rate, chemical behavior in the environment and biological factors. Many chemicals used in forestry applications break down fairly rapidly under normal conditions, usually within several weeks. Chemicals can enter streams through a variety of mechanisms, by direct application, drift, mobilization of residues in water overland flow and leaching. The most significant transport pathway will be direct application, drift, and mobilization during periods of heavy precipitation and overland flow. The most effective means for reducing this likelihood is to maintain a buffer between the treatment area and waterbodies, and to plan appropriately for application time frames.

Herbicide application to control competing vegetation does not disturb the nutrient rich topsoil layer, create additional bare soil, or adversely affect watershed condition when used responsibly (Nearly and Michael, 1996). By utilizing herbicides, the organic matter is left in place and off-site soil movement does not increase the loss of nutrients following harvest activities compared to the other types of management practices. Maxwell and Neary (1991) concluded in a review that the impact of vegetation management techniques on erosion and sedimentation of water resources occurs in this order: herbicides < fire < mechanical. They

also concluded that sediment losses during inter-rotation vegetation management could be sharply reduced by using herbicides and moderate burning instead of mechanical methods and heavy burning.

When herbicide fate is measured in runoff water, two common outcomes are apparent. First, measured peak concentrations are of short duration. Second, the highest concentrations occur when buffer strips are not used on streams or where the streams were accidentally over flown during aerial application (Neary and Michael, 1996). No aerial applications are planned for this project. Glyphosate has been frequently used in forest ecosystems because of its low mobility. It is readily immobilized by organic matter in the forest floor. Most studies have measured peak glyphosate concentrations in stream flow at or below 10 milligrams per cubic meter (mg/m<sup>3</sup>) (an order of magnitude below the EPA established Health Advisory Level [HAL]). As seen with other herbicide data, the highest glyphosate peak concentrations occur when buffer strips are not used as a BMP (Neary and Michael 1996).

Picloram and Triclopyr are also common herbicides used in forestry applications. In a review of studies looking at stream flow fate of these herbicides, a similar pattern is noted as with other herbicides, that the highest peak concentrations are found when buffer strips are not utilized as BMPs. When buffer strips are employed as a mitigation measure, peak concentrations of these chemicals have not been found to exceed 40 mg/m<sup>3</sup>, below the Reference Dose (RFD) of both Triclopyr and Picloram. Some agricultural crops can be affected by Picloram levels < 50 mg/m<sup>3</sup> (Neary and Michael, 1996). Where buffer strips are used or other mitigation techniques are employed, forestry herbicides generally do not pose a threat to water quality. Peak concentrations are usually low (< 100 mg/m<sup>3</sup>) and do not persist for long periods of time (< 6 mos.) (Neary and Michael, 1996).

Forestry use of herbicides poses a low pollution risk to groundwater because of its use pattern. Herbicide use in forestry is likely to occur only once or twice over rotations of 25 and 75 years. The greatest potential hazard to groundwater comes from stored concentrates, not operational application of diluted mixtures (Neary and Michael, 1996). Regional, confined, groundwater aquifers are not likely to be affected by silviculture herbicides (Neary, 1985). Surface unconfined aquifers in the immediate vicinity of herbicide application zones have the most potential for contamination. It is these aquifers which are directly exposed to leaching of residues from the root zone. The only known groundwater contamination incidents of any importance (contamination of bedrock aquifers, persisting > 6 mos., concentrations in excess of the water quality standard, etc.) in the southeastern U.S., where higher amounts of forestry herbicides are used, involved extremely high rates of application, or spills of concentrates. In these situations, herbicide residue was detected in ground water 4 to 5 years after the contamination. These situations are definitely not typical of operational use of forestry herbicides. Proper handling precautions during herbicide transport, storage, mixing, loading and clean-up are extremely important for preventing groundwater contamination (Neary and Michael, 1996).

Although short-term, low-level stream contamination has been observed for ephemeral to first-order streams draining studied sites, levels of herbicides in these streams have been neither of sufficient concentration nor of sufficient residence time to cause observable impacts on aquatic ecosystems (Michael, et al., 2000). These studies have, with a few exceptions, confirmed the absence of high levels of contamination of surface water. Thus,

herbicides used properly can help protect water quality in the reduction of sediment in streams while accomplishing forest management goals. It is imperative that pesticides, unless clearly labeled for aquatic uses, must not be applied directly to water, and pesticides should be used around water resources which are particularly sensitive only after careful considerations of the ramifications (Michael, et al., 2000).

From a review of literature surrounding herbicide application and use on forest lands, and monitoring conducted on the OSFNFs, it has been determined that the selection of this alternative could potentially result in low levels of herbicide residues entering waterbodies within the project area (SO unpublished reports). However, the levels found in the past and those anticipated for the future, are expected to be very small, and not in excess of the levels of concern established by the EPA. The OSFNFs utilize standards for herbicide application which require buffers between treated vegetation and waterbodies, as well as standards to ensure that drift and direct application to water bodies do not occur. This alternative includes the use of BMP practices and monitoring to ensure environmental quality is maintained.

When used for site preparation, herbicides are not broadcast but applied by direct injection or foliar spray. For these purposes, herbicide use is infrequent (1-2 times per 100 yrs.) and direct application methods would minimize off-site movement. Forest-Wide Standards for herbicide application will be followed as well as appropriate BMPs designed to limit risk to water quality. Monitoring for herbicides used on the forests has been a continuous policy on OSFNFs for over 10 years. Results from this monitoring have not documented any significant concentrations of herbicides off-site from their application (unpublished reports).

As mentioned in alternative 1, roads are the most common source of accelerated erosion on National Forest lands. Road-generated sediment may result from the erosion of cut and fill slopes, ditches, road surfaces, and road maintenance operations. Unpaved roads paralleling and crossing streams pose specific risks to water quality as they often maintain direct linkages with the stream channel. Roads result in three primary effects on forested lands; intercept rainfall directly, concentrate flow, and divert or reroute water from traditional hydrologic pathways. Through these actions, road systems mimic the stream channel network, effectively increasing the drainage density of streams in the landscape. This may result in modifications to the timing of water delivery to stream systems; however, this is not expected to be a measurable difference from current conditions. The activities of the selected action will work toward 'disconnecting' the road system from the stream network.

The reconstruction of 8.8 miles of roads and 4.4 miles of temporary roads will be implemented for this project. Road reconstruction in areas near streams could be responsible for large sediment delivery rates to the streams if proper BMPs are not followed and heavy rainfall events occur during construction. Guidance provided in the RLRMP and the Arkansas Forestry Silviculture BMP manual outlines the mitigation measures necessary to conduct these activities while controlling contributions to non-point source pollution. Approximately 18.6 miles of road will be decommissioned as part of this project, resulting in a decrease of potential sediment due to an overall decrease in road density for the watershed. The remainder of the road work is maintenance, which when properly conducted, should result in a net decrease in sediment production, thus a benefit.

The main effect of burning on water quality is the potential for increased runoff of rainfall. Runoff may carry suspended soil particles, dissolved inorganic nutrients, and other materials

into adjacent streams and lakes, reducing water quality and degrading fish habitat (Wade and Lundsford, 1989). However, most studies in the south indicate that effects of prescribed fire on water quality are minor and of short duration when compared with effects of other forest management practices. For example, Neary and Currier (1982) reported no adverse effects to water quality after a severe wildfire in heavy fuels in the Blue Ridge Mountains of South Carolina. In the Georgia Piedmont, low-intensity fires have had little effect on hydrologic properties of soils (Brender and Cooper, 1968) and stream water quality (Douglass and Van Lear 1983). Even where sedimentation and dissolved nutrients increase in stream water in response to burns, the amounts are often negligible. For example, Neary and Courier (1982) reported that wildfires in the Blue Ridge Mountains resulted in a threefold increase in NO<sub>3</sub>, but resulting concentrations were still low (0.012 mg N per liter). After a site-preparation burn in north Mississippi, Ursic (1970) reported that although sediment levels on burned watersheds were several-fold greater than those of control plots, sediment output was only about 0.5 ton per acre per year. Phosphorus and major cations often increase in stream flow and soil solution after intense slash fires, but the effects are of short duration and of a magnitude not considered damaging to surface water or site productivity (Tiedemann and others 1979). Van Lear and Waldrop (1988) concluded that properly conducted site-preparation burns cause minor nutrient loss and stream sedimentation compared with those resulting from mechanical methods of site preparation. Rapid vegetation regrowth in this part of the country quickly protects any disturbances to the landscape.

The direct and indirect impacts from this project are not expected to contribute to degradation of the current water quality. Implementation of the activities associated with these alternatives will result in some of the above mentioned effects to water quantity and quality; these effects have been shown from past research to be minimal and short-lived in this part of Arkansas. The most likely effects from the alternative, beyond current conditions, is short-term increase in sediment resulting mainly from road activities and minimal increases in water production. With the application of the Arkansas Forestry Commission's BMPs for silviculture, current Forest Plan Standards, and any other mitigation measures noted in this EA, the activities of this alternative should not result in detrimental effects to the water resources or compliance with water quality regulations. Road stabilization through maintenance and construction, erosion control through re-vegetation of disturbed ground, and streamside management zones (SMZ) around surface water features are typical measures used to ensure the mitigation of adverse effects which may occur.

### **Cumulative Effects**

For this analysis, the cumulative effects to water resources will be bound by the 6<sup>th</sup> level watershed in which the project is located (see Current Conditions). Cumulative effects result from practices which occur throughout the watershed, on both private and public lands. Activities and land uses identified for areas not administered by the Forest Service were determined from publicly available data. The major non-point source pollution concern that arises from Forest Service activities is that of soil erosion which can potentially result in increased sedimentation of aquatic habitats or threaten water quality as turbidity.

The cumulative effects analysis estimates sediment yield from both public and private lands, the existing road network, and from expected current and future activities. Current and future sediment yield is compared to estimates of an undisturbed landscape (or past condition). An undisturbed landscape is described as an entirely forested watershed without

roads. Sediment increases are then calculated as a percent above the undisturbed amount. This value is compared to potential risk values for identifying levels of concern for watershed conditions. These risk indicator values were empirically determined using a relationship between sediment values and the condition of the fisheries from select locations across the area.

The cumulative effects analysis assumes that particular activities occur on public and private lands. The assumption is made that all the activities on public lands as described under each alternative, will occur during a one-year time frame, or as an instantaneous event. In practice, these activities are usually spread over a number of years, thus amortizing the potential effects over the life of any resulting projects. Assumptions are included in the determination of the potential risk indicator values; these values were determined on a smaller-scale, ecoregion basis, using community-based fish information. Different guilds within the fish communities were analyzed for predictive patterns of response to sediment loading. The most responsive patterns were used to set the risk level values. This allows for a determination of the 'worst case' scenario, providing a conservative understanding of effects to the water resources and designated use fisheries.

There are two risk values for every 6<sup>th</sup> level watershed; the first separates the low and moderate concern level and the second separates the moderate and high concern level. A low concern indicates a minimal risk to water quality, or no expected adverse effects to water resources or the designated uses. A moderate concern indicates that care should be taken designing and implementing the project to avoid adverse effects and that additional aquatic monitoring should occur prior to project implementation. Proper application of all Forest Plan Standards and Arkansas BMPs should be verified for implementation. Assuming these guidelines are correctly applied, this project will result in minimal risks to water quality; if these standards are not applied, then a greater risk to water quality results. A high concern signals that the water resources may be threatened by the current or future state of the watershed. Proposed activities should only be conducted with the application of appropriate Forest Plan Standards and BMPs. Short-term adverse effects to water resources may result from activities captured in the effects analysis, both on public as well as private lands. Additional monitoring is necessary to determine that no adverse effects to the water resources are the result of Forest Service activities; this includes monitoring for adequate BMP compliance.

The water resource cumulative effects analysis was completed based on the activities described in this document. All supporting material for this model has been included in the project planning files. The results of this analysis are displayed in Table 17. This analysis indicates that the watershed analysis area currently has a low concern level in three of the watersheds and remains at the original moderate concern level in the North Fork-White Oak Creek. It should be noted that, although listed as moderate concern, the sediment level decreases for this watershed due to decommissioning of the roads. As a result of the no action alternative, sediment increases slightly but the concern level remains Low. Sediment increases for the no action alternative because roads that will be decommissioned in the selected alternative remain in place. Under the selected alternative, the concern level remains low and sediment decreases from the current condition in two of the four watersheds due to elimination of approximately 19 miles of unneeded roads.

**Table 17. Results of the Water Resources Cumulative Effects Analysis**

Percent increase of sediment above undisturbed conditions						
	Current		Future			
			No Action		Proposed	
6th level Watershed Analysis Area	% increase	Concern Level	% increase	Concern Level	% increase	Concern Level
<b>111102010701</b> <b>Clear Creek-</b> <b>Mulberry River</b>	216	Low	217	Low	218	Low
<b>111102010703</b> <b>Mountain Creek-</b> <b>Mulberry River</b>	215	Low	215	Low	206	Low
<b>111102010706</b> <b>Spirits Creek-</b> <b>Mulberry River</b>	428	Low	430	Low	434	Low
<b>111102010902</b> <b>North Fork-White</b> <b>Oak Creek</b>	513	Moderate	522	Moderate	513	Moderate

The cumulative effects analysis indicates minimal risks to the water resource's current condition. The activities implemented by the Forest Service for the selected action would result in an overall decrease in sediment production from the landscape. Additionally, it should be possible to schedule these activities over time instead of instantaneously as predicted by the analysis, thus further reducing the possibility of acute effects. Through the use of Forest Plan Standards and the use of Arkansas Silviculture BMPs, the activities scheduled for implementation should not pose additional risks to water quality or designated uses. Monitoring in the form of subsequent fisheries evaluation and BMP compliance checks should be adequate to discern any adverse effects which may result from the implementation of the selected action.

## **2. Soil Resources**

### **Existing Condition**

The project area is located on the southern side of the Ozark Plateau in a heavily dissected section called the Boston Mountains. Project area elevation varies from about 720 feet at the southern tip of the project area on Little Piney Creek to 2,060 feet on the summit of Brushy Mountain. Several types of topography exist in this Boston Mountain section. Most of the timber harvest would occur on a common stair-stepped landform, called "Bluff-Bench" topography, that developed from the long-term weathering/erosion of sedimentary layers of different hardness, mainly shales and sandstones. The remainder of the topography varies from nearly level to rolling mountain tops that developed from weathering of level bedded sandstones to narrow to very narrow alluvial areas along Barron Creek, Devils Den Hollow, Bingham Hollow, and Ben Hollow. Most of the mountain tops and creek bottoms and some wider benches now or have been under cultivation or in pastures, and some are still under private ownership. Project area topography varies from 0-3 percent slope on mountain tops,

benches, and creek bottoms, to fairly steep 40%-60% on the 200 to 300 foot slopes between the benches and just above the stream bottoms.

Geology consists of interbedded acid sandstone, siltstone, and shale of the Atoka Formation, which is part of the Pennsylvania System of the Paleozoic Era. Streams strongly dissected the level plateaus into relatively narrow valleys with rolling and steeper slopes and stair-stepped topography called "Bluff-Bench". As a result of the contrasting weathering resistance to erosion, the interbedded sandstone-shale formed a series of "riser" and "treads" that resemble stairways. Of these rocks, the sandstone is the most resistant to weathering and capped the mountaintop and free faces ("risers"). The Linker Hartsells, and Mountainberg soils are formed from this parent material. The soils on benches ("treads") along the mountainside are formed from loamy and silty slope alluviums from a high elevation.

Most of the soils have 100% cover consisting of leaf litter twigs, limbs, logs, gravel, stones, and have an intact root mat. Soils in the road beds of closed roads have some ground cover protecting them, but are mostly bare and eroding in some sections.

The potential disturbance for the soil resource resulting from timber harvest was estimated using the average percent of the harvest units that had soil disturbance resulting from pine thinning that was obtained from soil disturbance monitoring done on the OSFNFs during 1993-2007. Estimates of temporary loss of soil productivity that would last 25 years or less assume that all of the proposed activities would occur within 1 year. This is a worst case assumption, which is highly unlikely to occur, but it demonstrates the maximum potential soil productivity loss for the project area. Recovery from the temporary loss in soil productivity is expected to occur within 20 to 25 years based on monitoring done on the Magazine Ranger District in 1981 and 2001.

### **Direct and Indirect Effects**

#### **Alternative 1**

The roads listed for reconstruction, maintenance, and decommissioning would continue to erode.

#### **Alternative 2**

Approximately 23% (2,966 acres) of the project area will sustain a temporary reduction in soil productivity due to harvesting operations. The temporary reduction will last 25 years or less. An additional 8.9 acres (<1% of the harvest area) will sustain a temporary reduction in soil productivity due to temporary road construction. Soil productivity will be lost on approximately 5.4 acres due to road reconstruction. Approximately 8 acres of the harvested area will sustain a temporary reduction in soil productivity due to fireline construction. Approximately 19 miles of road will be decommissioned which will greatly improve soil productivity.

Temporary roads, primary skid trails, and landings will be disked, seeded and closed following harvesting to speed the recovery of the soil productivity. Firelines will be bladed and seeded when prescribed burning is completed to speed recovery of soil productivity and to prevent erosion. Road reconstruction will stabilize roads and prevent loss of productivity on soils adjacent to these roads and will reduce erosion and sedimentation. Road maintenance will also prevent the loss of productivity on soils adjacent to the roads by



helping to control runoff. Less than 15% of an activity area can sustain a reduction in soil productivity, according to the RLRMP standard. If more than 15% of the activity area sustains a reduction in soil productivity, mitigation measures must be installed. The documentation for temporary reduction in soil productivity can be found in the analysis file.

The use of herbicides will have no impact on soil disturbance because stems and roots of treated plants will remain in place until they decay. Soil microbes will break down any herbicide residue that reaches the soil.

The herbicides that are to be used are not expected to have any negative impacts on the soils. A brief summary of each of the herbicides characteristics relating to soils is given below.

Glyphosate is readily absorbed by foliage. It had practically no leaching characteristics because it binds tightly to the soil ([e.g., Alex et al. 2008; Landry et al. 2005; Mamy and Burrisuso et al. 2005] cited in SERA 2011). Soil binding of glyphosate is directly proportional to the organic carbon in the soil (e.g.; Winegardner 1996 cited in SERA 2011). In soil, it is highly susceptible to degradation by microorganisms, being converted to natural products such as carbon dioxide and water. Many species of soil microorganisms can use glyphosate as their sole carbon source (Dick and Quinn 1995a; Dick and Quinn 1995b; Dotson et al. 1996; Wardle and Parkinson 1992a) [cited in SERA 2011]). Microorganisms like higher plants, use the shikimate pathway to produce aromatic amino acids. Since glyphosate inhibits this pathway, it is potentially toxic to microorganisms (Cox 2002; Issa 1999 [cited in SERA 2011]). Nonetheless, there is very little information suggesting that glyphosate will be harmful to soil microorganisms under field conditions and a substantial body of information indicating that glyphosate is likely to enhance or have no effect on soil microorganisms (Busse et al. 2001; Wardle and Parkinson 1990a; Wardle and Parkinson 1991 [cited in SERA 2011]). Persistence in soils is about two months or less.

Picloram is extremely soluble in water. Hexachlorobenzene is a contaminant in Picloram that is much less soluble in water. Hexachlorobenzene is highly persistent in soil with metabolic half-lives of about 3 to 6 years. Conversely, Hexachlorobenzene is relatively volatile and is expected to dissipate rapidly from soil surfaces (SERA, 2011). Studies on soil microorganisms suggest that both Picloram and Picloram metabolites may impact soil microorganisms. Although Picloram could have an effect on soil microorganisms, the consequences of such effects are not clear. No field studies linking adverse effects on soil microorganism with detectable adverse impacts on soil productivity have been encountered (SERA, 2011). Picloram chemically attaches to clay particles and organic matter. Breakdown caused by sunlight and microorganisms in the soil are the main ways in which Picloram degrades in the environment. Picloram will dissipate more quickly in warm, wet weather. Alkaline conditions, fine textured clay soils, and a low density of plant roots can increase the persistence of Picloram. Carbon dioxide is the major end product of the breakdown of Picloram in the soil. The half-life of Picloram in soil is reported to vary from 1 month under favorable conditions to more than 4 years in arid regions (USDA, 1989). At high application rates, Picloram may inhibit microbial activity (Kryszowska et. al. 1994 [cited in USFS PNW Region 2000]). At a level of 10 ppm in sandy loam soil, Picloram caused transient decrease in nitrification after 2 but not 3 weeks of incubation and no effect on ammonia formation or sulfur oxidation (Tu 1994 [cited in USFS PNW Region 2000]). The decrease in nitrification was relatively mild and does not portend a substantial or prolonged impact on microbial activity. Bacteria and fungi can utilize Picloram as a single

source of carbon and nitrogen. It increases the number of ammonifying bacteria (Spiridonov, Smokhalov, and Rudakov, 1981, [cited in Brown et. al. 1990]). The warm weather at the time of application, the high density of plant roots, and the acidic soil conditions are expected to rapidly breakdown the Picloram.

Triclopyr is absorbed by plant roots, but it is not considered effective as a soil-applied herbicide. Triclopyr is adsorbed primarily to organic matter particles in soil. The organic matter content is the primary factor in the degree of soil adsorption. Long-term forest and pasture field studies found very little indication that Triclopyr will leach substantially either horizontally or vertically in loamy soils (SERA, Inc. 1996c [cited in USFS PNW Region 1996]). Microorganisms degrade Triclopyr readily. It degrades more rapidly under warm, moist conditions which favor microbial activity. Average soil half-life for Triclopyr formulation are 0.2 days for Triclopyr butoxyethyl ester (BEE); 14 days for Triclopyr acid; and 69 days for 3,5,6-trichloro-2-pyridinol (TCP) which is one of the major metabolites of Triclopyr (SERA, 2011b). Several diverse studies are available on the toxicity of Triclopyr to terrestrial microorganisms. None of these studies suggests that Triclopyr is likely to have an impact on soil organisms (SERA, 2011b). There is little indication that concentrations of Triclopyr in soil are likely to adversely affect soil invertebrates. There are numerous field studies suggesting that effects on terrestrial invertebrates are most likely to be associated with changes in habitat and food availability rather than direct toxic effects from Triclopyr (SERA, 2011b). The warm temperatures at the time of application and the high density of plant roots are expected to rapidly degrade Triclopyr.

Hexazinone is very water soluble and readily leaches through soil. The principal routes of loss are from photodegradation and plant and microbial metabolism (USDA 1984 cited in Michael et al. 1999). Clearly soil factors, temperature, and precipitation duration and intensity play major roles in the leaching of Hexazinone through soil profiles (Michael et al. 1999). Michael and others (1999) concluded in their study that the impact of Hexazinone on soil microbes and particularly mycorrhizal fungi will be minimal, even at the rate of 6.72 kg/ha, 3 times that listed on the label for site preparation for the study site. Additional field studies are available that demonstrate no adverse effects on terrestrial microorganisms after applications at rates that are substantially above those used in Forest Service programs (SERA, 2005). Half-life of Hexazinone in soils from field tests ranged from 24 to 365 days. In laboratory studies the half-life in soils ranged from 74 to 80 days (Michael et al. 1999).

Imazapyr is relatively non-toxic to soil microorganisms, aquatic invertebrates, and fish. Effects on bacteria appear to be highly species specific with variations in sensitivity of up to a factor of 100. Imazapyr appears to have the potential to shift bacterial soil populations that contain sensitive species of bacteria. There does not appear to be any basis for asserting that Imazapyr is likely to adversely affect microorganisms in soil. If Imazapyr were extremely toxic to terrestrial microorganisms that are important for the maintenance of soil suitable for plant growth, it seems reasonable to assume that secondary signs of injury to microbial populations would have been reported (SERA, 2011a). Degradation half-time in soils ranges from 5.9 to 8.1 years (SERA, 2011a).

Imazapic's effect on soil invertebrates and soil microorganisms is not known due to lack of information. If Imazapic were extremely toxic to terrestrial microorganisms that are important for the maintenance of soil suitable for plant growth, it seems reasonable to assume that secondary signs of injury to microbial populations would have been reported (SERA,

2004). Degradation halftime in soils ranges from 106 to 113 days (SERA, 2004).

### **Prescribed Burning Effects on Soils**

Fire affects soil through transfer of heat into the duff layer and underlying soil. These effects vary considerably depending upon fire intensity, duration, and soil conditions. Prescribed fire has the potential to affect soil's physical, chemical, and biological properties. Prescribed burns are generally planned to burn at low to moderate intensities, limiting adverse impacts. These fires are often designed to reduce fuel loadings that reduce the likelihood of detrimental impacts from subsequent wildfires (RLRMP, 2005).

The most important soil physical characteristic affected by fire is soil structure because the organic matter component can be lost at relatively low temperatures. Organic matter helps to hold soil particles together and along with biofilms created by soil organisms, aggregates are formed which make up soil structure. The magnitude of change in soil physical properties depends on the temperature threshold of soil properties and the severity of the fire (DeBano and Neary, 2003). When the litter and duff are completely consumed by a high severity fire, the soil is bare and subject to raindrop splash and erosion. Moderate burns cause minor erosion because they expose soil on less than 20% of the area and recovery usually takes one year. Light burns cause no erosion because they expose almost no soil (Dissmeyer and Stump, 1978). Prescribed under-burns are usually light to moderate, so their effect on erosion is generally negligible (RLRMP, 2005). Low-intensity burns have little, if any adverse effect on soil erosion even on relatively steep slopes (Brender and Cooper, 1968 Cushwa and others, 1971, Goebel and others, 1967 [cited in Stanturf and others 2002]). The remaining duff, root mat, surface gravel and stones protect the soil from erosion after the burn.

Soil organic matter plays a key role in nutrient cycling, cation exchange, and water retention in soils. When organic matter is combusted, the stored nutrients are either volatilized or are changed into highly available forms that can be readily taken up by microbial organisms and vegetation (Knoepp, DeBano, and Neary 2005). The magnitude of nutrient losses during burning is positively and linearly correlated with fuel consumption (Hough 1981; Raison et al, 1985a; Schoch and Binkley, 1986 [cited in Carter and Foster, 2003]). Liechty and others (2004) concluded that shortleaf pine-bluestem restoration, which includes harvesting, midstory reductions, and prescribed fire, can alter nutrient availability within surface soils. They found that pH, Ca, total N, C, and C:N ratios were increased by approximately 20 years of restoration activities.

Low-severity prescribed fire has a minimal effect on soil biota because maximum temperatures are generally nonlethal, except for the upper litter layer, and consumption of forest floor habitat is limited (Busse and DeBano, 2005).

### **Cumulative Effects**

The areas selected for timber harvest have not been harvested for 10 years or more and show little to no evidence of detrimental soil disturbance consisting of rutting, displacement of the top soil, compaction, or erosion. There are no known future activities in addition to the selected action that would impact soils. Skid trails, log landings, and temporary roads will be smoothed, disked, and seeded to prevent erosion and to speed soil recovery. Soil disturbance

that will potentially result from the selected action are expected to be within the RLRMP standard that requires that on soils dedicated to growing vegetation, the organic layers, topsoil, and root mat will be left intact over 85% of activity areas.

### **3. Climate Change**

#### **Existing Condition**

Research and analysis of evidence dating many years ago show intervals of warming and cooling on earth. The current warming trend is particularly important because it is proceeding at an unusual rate. Assessments by the Intergovernmental Panel on Climate Change (IPCC) suggest that the Earth's climate has warmed between 0.6 and 0.9 degree Celsius over the past century and that human activity affecting the atmosphere is "very likely" an important driving factor (USDOE, Energy Information Administration 2008).

The following information is from the National Climatic Data Center (NCDC) website (<http://lwf.ncdc.noaa.gov/oa/climate/gases.html>): Many chemical compounds present in Earth's atmosphere behave as greenhouse gases. These are gases which allow direct sunlight (relative shortwave energy) to reach the Earth's surface unimpeded. As the shortwave energy (that in the visible and ultraviolet portion of the spectra) heats the surface, longer-wave energy (heat) is reflected to the atmosphere. Greenhouse gases absorb this energy, thereby allowing less heat to escape back to space, and 'trapping' it in the lower atmosphere. Many greenhouse gases occur naturally in the atmosphere, such as carbon dioxide, methane, water vapor, and nitrous oxide, while others are synthetic. Those that are man-made include the chlorofluorocarbons, hydrofluorocarbons and perfluorocarbons, as well as sulfur hexafluoride. Atmospheric concentrations of both the natural and man-made gases have been rising over the last few centuries. As global population increases and reliance on fossil fuels (such as coal, oil and natural gas) is firmly solidified, emissions of these gases continue to rise. While gases such as carbon dioxide occur naturally in the atmosphere, through our interference with the carbon cycle, we artificially move carbon from solid storage to its gaseous state, thereby increasing atmospheric concentrations (NCDC 2009).

The principal greenhouse gases that enter the atmosphere because of human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases (USEPA 2009). Atmospheric carbon dioxide concentration is now higher than at any time in the past 10 million years (Kennedy and Hanson 2006). Humankind has altered the natural carbon cycle by burning coal, oil, natural gas and wood and since the industrial revolution began in the mid-1700s, each of these activities has increased in scale and distribution. Prior to the industrial revolution, concentrations were fairly stable at 280 ppm. Today, they are around 370 ppm, an increase of well over 30% (NCDC 2009). In 2006, carbon dioxide emissions from the United States accounted for about 20% of the amount added to the atmosphere globally. Fuel combustion accounted for 94.0% of U.S. carbon dioxide emissions in 2007; this figure represents approximately 85.4% of the nation's total greenhouse gas emissions that year. Changes in land use and forestry practices can also emit carbon dioxide through conversion of forest land to agricultural or urban use or can act as a sink for carbon dioxide (USEPA, 2009).

Numerous processes collectively known as the “carbon cycle” naturally regulate concentrations of carbon dioxide in the atmosphere. Natural processes, such as plant photosynthesis, dominate the movement (“flux”) of carbon between the atmosphere and the land and oceans. Carbon sequestration is the process by which atmospheric carbon dioxide is taken up by trees, grasses, and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage and roots) and soils. The sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide to the atmosphere, such as deforestation, forest fires and fossil fuel emissions. Carbon accumulation in forests and soils, however, eventually reaches a saturation point, beyond which additional sequestration is no longer possible. This happens, for example, when trees reach maturity, or when the organic matter in soils builds back up to original levels before losses occurred (USEPA, 2009). While natural processes can absorb some of the net 6.2 billion metric tons (7.2 billion metric tons less 1 billion metric tons of sinks) of anthropogenic (human-caused) carbon dioxide emissions produced each year (measured in carbon equivalent terms), an estimated 4.1 billion metric tons are added to the atmosphere annually. This positive imbalance between greenhouse gas emissions and absorption, results in the continuing increase in atmospheric concentrations of greenhouse gases (USDOE, Energy Information Administration, 2008).

In computer-based models, rising concentrations of greenhouse gases produce an increase in the average surface temperature of the Earth over time. Rising temperatures may, in turn, produce changes in precipitation patterns, storm severity, and sea level commonly referred to as “climate change” (USDOE, Energy Information Administration 2008). Projected climate change impacts include air temperature increases, sea level rise, changes in timing, location and quantity of precipitation and increased frequency of extreme weather events such as heat waves, droughts, and floods. These changes will vary regionally and affect renewable resources, aquatic and terrestrial ecosystems, and agriculture. Changes in temperature and precipitation will alter the growth patterns and distribution of plant and animal species. There are uncertainties regarding the timing and extent magnitude of climate change impacts, but continued increases in human greenhouse gas emissions will likely lead to increased climate change.

### **Direct and Indirect Effects**

#### **Alternative 1**

It is currently not possible to predict the actual effects of a project on global climate change, so a baseline comparison cannot be made using the no action alternative relative to climate change.

Much of the project area is currently susceptible to climate change events such as prolonged drought due to the stressed conditions of individual trees. Tree crowns and roots have little or no room to expand and stems in crowded stands compete for water and nutrients. Under these conditions, trees are much more likely to die due to added stress from climate change events. If overstory trees die, sustainability of overstory tree species will be in question due to the lack of advanced oak and pine regeneration in the understory.

Because fuel loads within the project area would not be reduced, the potential for an uncharacteristically severe wildfire would persist and increase as fuels are added to the forest

floor through natural processes. In such an event, the quantities of carbon dioxide and other greenhouse gas emissions released into the atmosphere would be expected to be greater than those that would have been released under the controlled conditions of a prescribed burn or in an area where fuel reduction treatments had been conducted. The actual quantity of emissions released would depend on the acreage burned, tons of fuel consumed and the amount of time required to suppress the wildfire.

Harvest of trees that have reached or passed maturity would not occur. The ability of those trees to sequester additional carbon from the atmosphere would continue to be less than that of younger stands of trees. No wood products such as wood flooring, furniture and lumber that store carbon would be obtained from the project area.

## **Alternative 2**

Forests and soils have a large influence on atmospheric levels of carbon dioxide. The carbon stored in live biomass, dead plant material and soil represents the balance between carbon dioxide absorbed from the atmosphere and its release through plant respiration as well as decomposition and burning.

With this alternative, some of the carbon currently sequestered in vegetation and soils will be released back to the atmosphere. In the short-term, greenhouse gas emissions and alteration to the carbon cycle will be caused by hazardous fuel reduction activities, harvests and thinning overstocked stands. In the long-term, however, these actions will also increase the forest's ability to sequester additional carbon, improve the forest's resilience to the potential impacts of climate change and decrease the potential for uncharacteristically severe wildfires. Harvest will remove some of the mature stems with diminished ability to sequester additional carbon; some of the carbon sequestered in harvested stems will continue to be stored in manufactured wood products. Residual stems and regeneration in the project area will continue to sequester and store carbon.

Wildfires may still occur in the project area; however, because fuel loads will have been reduced with these alternatives, there will be a lower risk of uncharacteristically severe wildfire for the treated acres than the current condition poses. The reduced risk has a two-fold effect on greenhouse gas emissions or the carbon cycle:

- There is a direct beneficial effect on climate change of decreased greenhouse gas emissions from the treated acres; because the risk of acres being burned by uncharacteristically severe wildfires will be reduced.
- There is an indirect beneficial effect because live stands of trees will retain higher capacity to sequester carbon dioxide compared to stands killed by uncharacteristically severe wildfires, especially if not immediately reforested.

## **Cumulative Effects**

Although it is possible to estimate the quantity of greenhouse gas emissions prescribed burns associated with this project may release, there is no certainty about the actual intensity of the project's individual effects on global climate change. As greenhouse gas emissions are

integrated across the global atmosphere, it is not currently possible to ascertain the degree of indirect effects or cumulative impacts this project will have on global climate.

## **4. Air Resources**

### **Existing Condition**

The entire project area lies within lands designated as a Class II area with respect to the air resource. The Clean Air Act (CAA) defines a Class II area as “a geographic area designated for a moderate degree of protection from future degradation of the air quality.”

The RLRMP for the OSFNFs sets forth priorities related to air quality. Specifically, the RLRMP requires that the Forests work to:

- Prevent exceeding air quality standards from prescribed fire activity and other Forest actions;
- Plan for resource management emissions to fall within the current state implementation plan (SIP), which establishes acceptable levels of air pollution; and
- Minimize air pollution impacts to the Air Quality Related Values (AQRVs) of the Class I Area, Upper Buffalo Wilderness, through a cooperative working relationship with agencies managing air quality. Furthermore, the RLRMP establishes OBJ. 18, to protect and improve the AQRVs of Upper Buffalo Wilderness with performance indicators of the number of Prevention of Significant Deterioration (PSD) permits reviewed and the number of regional air quality planning committees participated in. The Air Quality Specialist working with the OSFNFs reviews all PSD permit applications for air quality impacts to the Upper Buffalo Wilderness, and works with local, state and federal air quality agencies to ensure that increases in acidic deposition or regional haze do not occur.

Air pollution often has a subtle but critical impact on ecosystems and vistas, and can alter ecosystems by harming plants and animals, or changing soil or water chemistry. Ecosystems then become more vulnerable to damage from insects and diseases, drought, or invasive species. Additionally, since many visitors to National Forests value pristine areas with magnificent vistas, air pollution can lessen their experience and enjoyment of the National Forests.

The main air pollutants of concern on the OSFNFs are ozone, fine particulate matter, and sulfur and nitrogen deposition. Ozone is a pollutant formed by emissions of nitrogen oxides and volatile organic compounds in the presence of sunlight. At elevated concentrations, it causes human health concerns as well as negative impacts to vegetation. The US Environmental Protection Agency (EPA), as directed by Congress, has set a National Ambient Air Quality Standard (NAAQS) for ozone of 0.075 parts per million (ppm) to protect both human health and the environment. Particulate matter is a mixture of extremely small particles made up of soil, dust, organic chemicals, metals, and sulfate and nitrate acids. The size of the particles is directly linked to health effects, with smaller particles causing the worst impacts to human health. As a result, EPA has set a primary NAAQS for ultra-small

(less than 2.5 microns in diameter) particulate matter on both a short-term (24-hour) and annual basis. The 24-hour (short-term) fine particulate matter (PM<sub>2.5</sub>) NAAQS is currently set at 35 µg/m<sup>3</sup>, while the annual PM<sub>2.5</sub> NAAQS is 12 µg/m<sup>3</sup>.

Air quality is recognized in the RLRMP for OSFNFs as an important parameter to measure forest health. The plan lists the following Forest-Wide Standards relating to air quality.

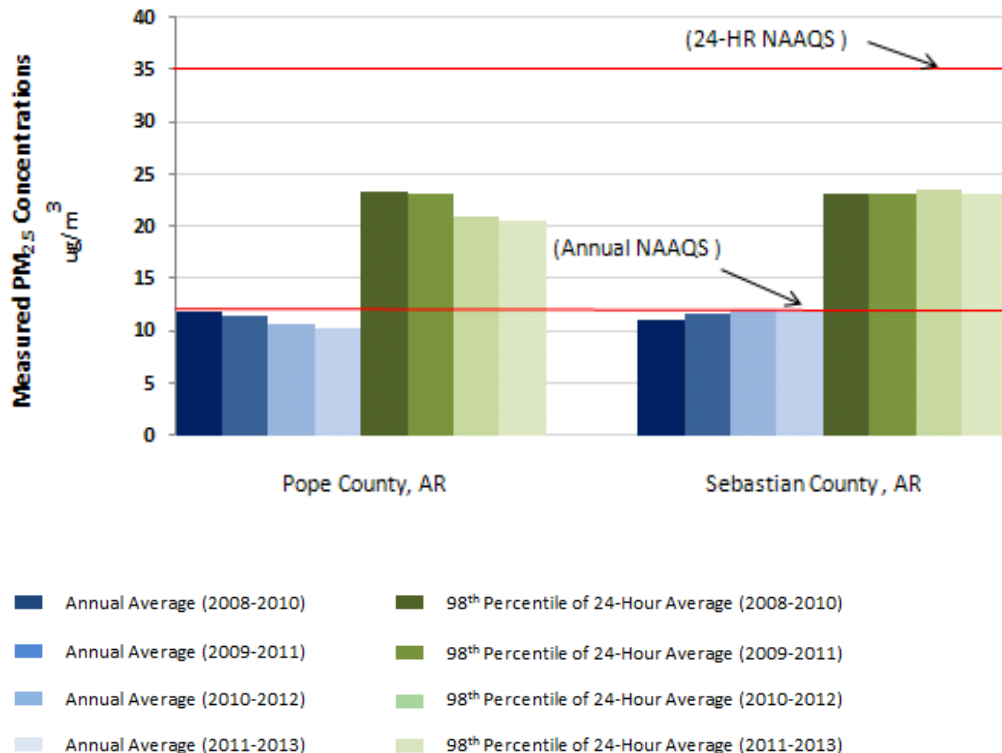
- FW93: Prescribed burning will be conducted in, or adjacent to, counties with forecasted high Air Quality Index (AQI) values (AQI equals orange and higher) only if meteorological conditions indicate that smoke will be carried away from the high AQI area.
- FW94: Conduct all National Forest management activities in a manner that does not result in (1) a significant contribution to a violation of National Ambient Air Quality Standards (NAAQS) or (2) a violation of the applicable provisions in the State Implementation Plan (SIP).

***Forest-Wide Standard FW93.*** The use of prescribed fire emits PM<sub>2.5</sub>, along with other pollutants. With the growing prescribed fire program, it is important for the National Forests to be aware of downwind concentrations of fine particulate matter to ensure that prescribed fire emissions are not contributing to any violations of the NAAQS. There are two PM<sub>2.5</sub> monitors near the OSFNFs. One is located in Pope County, Arkansas and the other is located in Sebastian County, Arkansas. The measured concentrations of fine particulate matter at each of these locations, both on a daily and an annual basis do not exceed the PM<sub>2.5</sub> NAAQS which are 35 and 12 µg/m<sup>3</sup>, respectively. Therefore, while prescribed fire may be contributing to nearby concentrations of PM<sub>2.5</sub>, the area is still meeting the NAAQS for this pollutant.

***Forest-Wide Standard FW94.*** NAAQs are based on three-year averages of the measured concentrations. Using 2008 through 2013 data, the measured concentrations near the OSFNFs Forests were compared to the 24-hour and the annual PM<sub>2.5</sub> NAAQS. As shown in Figure 4, these monitors have not recorded any exceedances of the PM<sub>2.5</sub> NAAQS over the past six years. Thus, it can be concluded that forest management activities are not resulting in any exceedances of the NAAQS.

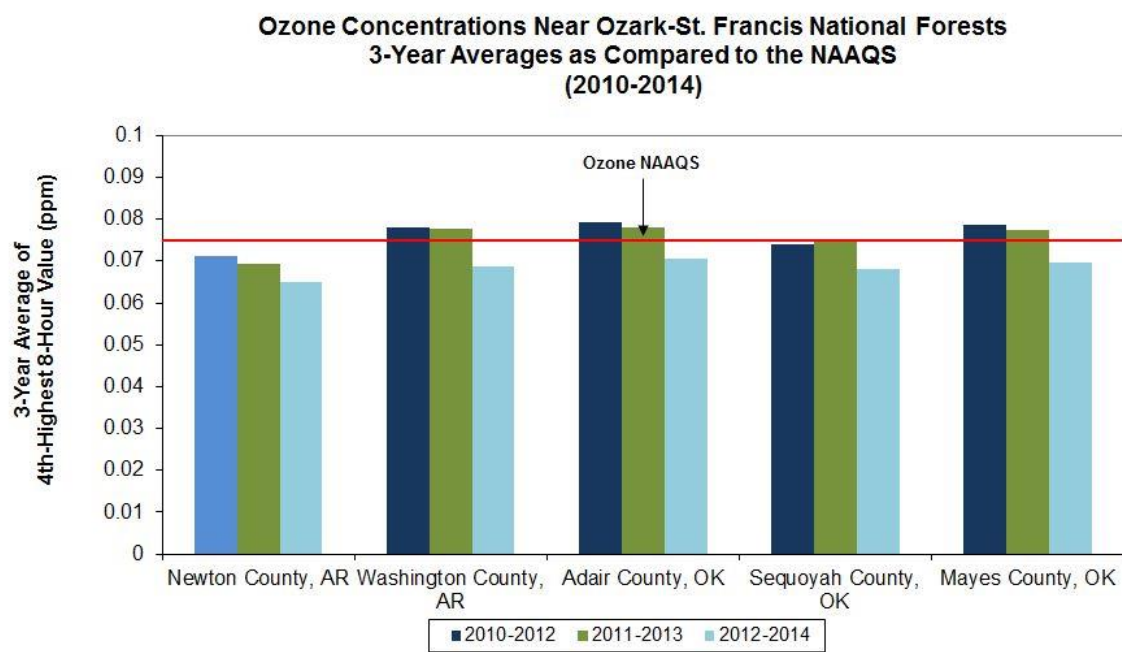


**Particulate Matter Concentrations Near Ozark/St. Francis National Forest  
3-Year Average As Compared to Both the Annual and 24-Hour NAAQS  
2008-2013**



**Figure 4. Particulate Matter Concentrations near the OSFNFs**

Ozone concentrations are also measured at several locations near the OSFNFs. The NAAQS is based on a three-year average of the 4<sup>th</sup> highest 8-hour ozone concentration. Figure 5 shows the nearby ozone concentrations as compared to the NAAQS. The three-year averages of ozone have recently risen in the past, but in the 2012-2014 three-year average, data shows all sites recorded a decrease in ozone levels except for Sequoyah County, Oklahoma; which shows a slight increase. Though most of the yearly averages are below the ozone NAAQS, both the 2010-2012 and the 2011-2013 three-year averages for Adair County, Oklahoma, are exceeding the NAAQS. All three-year averages for all counties for 2012-2014 are below NAAQS.



**Figure 5. Ozone Concentrations near OSFNFs**

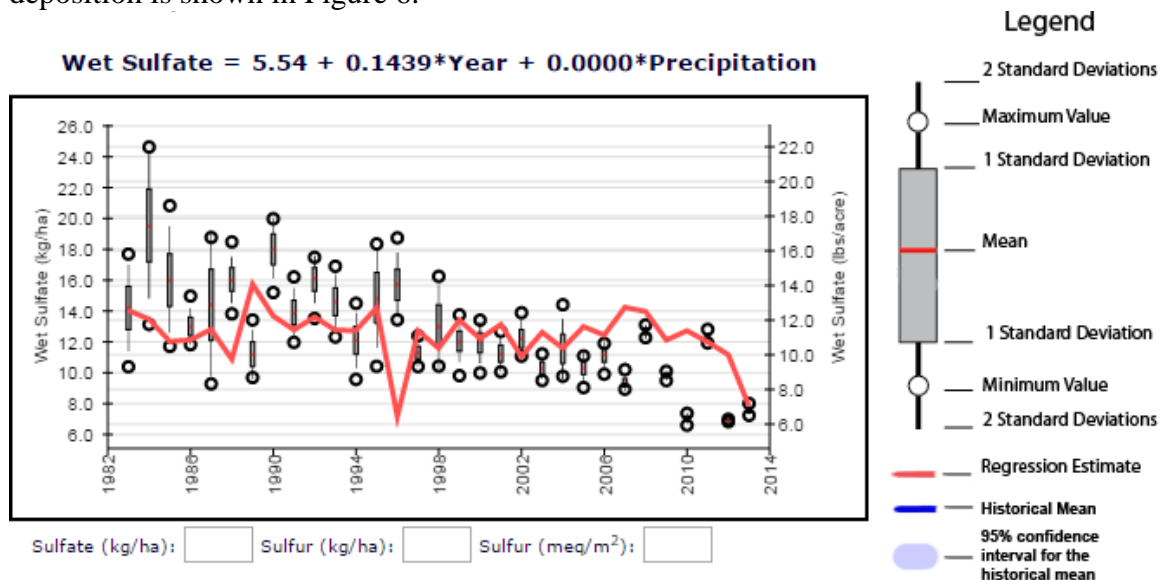
The atmosphere is a complex mixture of gases and other compounds and some are considered air pollutants because they can decrease visibility and have an adverse impact to people's health or to forest and aquatic ecosystems. As the atmosphere moves across the landscape, the air pollution can be deposited on the forest vegetation and soils. Scientists refer to this as dry deposition. Air pollutants can also travel through the atmosphere in the clouds and are deposited when it rains or snows; this can be called wet deposition or acid rain. The third method of deposition is when fog or clouds intercept the landscape, especially the tops of mountains. The amount of acid compounds deposited from clouds can be far greater than from dry deposition or rainfall and snow. The primary compounds in the atmosphere that contribute to acidification of forested ecosystems are:

- **Sulfur compounds** – Sulfur dioxide ( $\text{SO}_2$ ) is converted in the atmosphere and forms sulfates and sulfuric acid. Sulfur dioxide is released primarily from coal-fired power plants.
- **Nitrogen compounds** – Nitrogen oxides and ammonia ( $\text{NH}_3$ ) can increase nitrogen deposition. Most forest types respond favorably to nitrogen, which is usually limiting, except old growth spruce-fir ecosystems. Automobiles and utilities are the major sources of nitrogen oxides.

The deposition of acid compounds in high concentrations or for a long time period can impact forest nutrient cycling of base cations. Excessive removal of base cations from forest soils can lead to unhealthy vegetation, and poor water quality for aquatic biota.

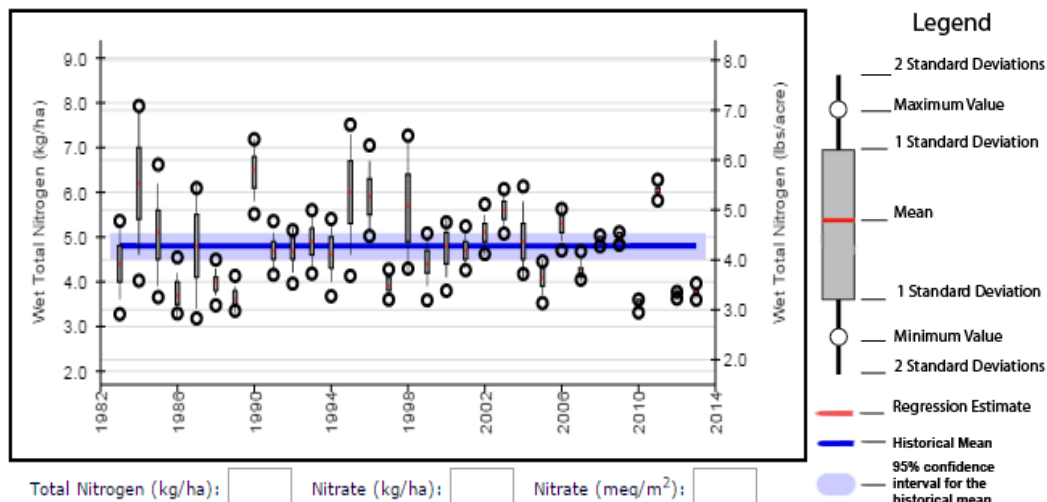
Wet Sulfate: Deposition has decreased on average about 0.2307 kilograms per hectare (kg/ha) each year. The model is highly significant with less than 1 in 1,000 cases where there is actually no relationship between the mean of the annual wet sulfate deposition as

predicted by the years since 1983 and the mean of the annual precipitation. Overall, 81% of the variation in the estimated mean of the annual wet sulfate deposition can be accounted for with the two predictors. The multiple regression model and graphic for wet sulfate deposition is shown in Figure 6.



**Figure 6. Wet Total Sulfate**

Wet total Nitrogen: The wet total nitrogen trend could not be determined because one or more multiple regression assumptions were not met, or the coefficient for the year and/or precipitation predictor was not significant. Therefore, figure 7 shows the historical mean of the annual wet total nitrogen deposition of 4.8 kg/ha with the true mean between 4.53 and 5.12 kg/ha for 95% of the time.



**Figure 7. Wet Total Nitrogen**

**PSD Permit Review.** The Clean Air Act and its amendments designate specific wilderness areas and national parks as mandatory Class I areas, and these areas are provided special protection against degradation of air quality related values such as visibility. The OSFNs manage one Class I area, the Upper Buffalo Wilderness. The Clean Air Act requires federal land managers with the “affirmative responsibility” to protect the air quality related values at

these Class I areas, and to consider whether a proposed new or modified source of air pollution may adversely impact these values. The OSFNFs work with state regulatory agencies in Arkansas and Oklahoma to determine if new or existing industry would impact air quality at Upper Buffalo Wilderness through the Prevention of Significant Deterioration (PSD) permitting process. Table 18 shows the number of proposed new or modified sources that were reviewed from 2009 to 2014.

**Table 18. PSD Permits Reviewed by the OSFNFs**

<i>Prevention of Significant Deterioration (PSD) Permits Reviewed by the Ozark-St. Francis National Forests</i>	
<b>Fiscal Year</b>	<b>Number of Permits</b>
2009	6
2010	3
2011	2
2012	5
2013	6
2014	4

None of these proposed facilities were shown to cause an adverse impact to the Upper Buffalo Wilderness.

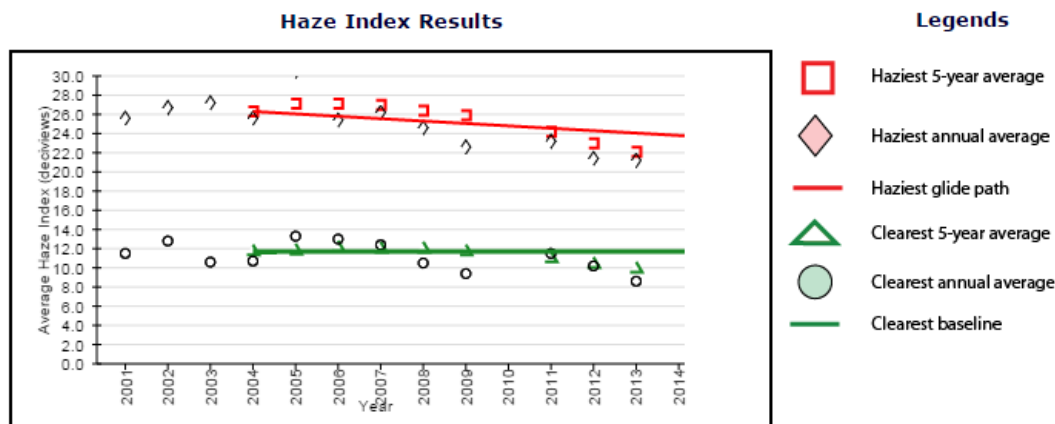
### Visibility

Visibility has been monitored at the federally mandated Class I Upper Buffalo Wilderness Area since 1993 following the Interagency Monitoring of Protected Visual Environments (IMPROVE) protocols (<http://vista.cira.colostate.edu/improve/>). Figure 8 is based upon analysis of particulate matter data that include estimates of visibility conditions and the amount of light extinction attributed to different types of particulate matter measured at this IMPROVE monitoring site.

The Regional Haze Program relies upon the haze index to track two different trends: visibility on the haziest days annually and on the clearest days annually. Both trends are measured beginning with the 2000-2004 “baseline” period. The haziest days are also compared to the goal of no manmade impairment in 2064. The haze index has a unit of measure called a deciview and a one unit change in a deciview may be noticeable under certain conditions. Higher deciview values correspond to hazier scenes.

Figure 8 shows the clearest and haziest annual deciview values for the entire data record for the Upper Buffalo Wilderness Area. The red line represents the haziest day “glide path” connecting the baseline conditions to the 2064 goal, and is intended to be a guide in gauging progress at this Class I area. The 2008 through 2012 haziest 5-year average (of available data) indicates the haze index is below the glide path; with 4 of 4 years below the red line in figure 8. On the clearest days, the past 4 of 4 years of the clearest 5-year average (of available data) have been below the 11.71 deciview baseline (green line below). (<http://webcam.srs.fs.fed.us/graphs/vis/index.php>).

Between 2008 and 2014, ammonium sulfate was the primary particle in the atmosphere contributing to the light extinction observed on the days classified with the haziest conditions. On the clearest days, ammonium sulfate was also the primary particle contributing to light extinction. (<http://webcam.srs.fs.fed.us/graphs/vis/index.php>).



**Figure 8. Haze Index Results**

## Prescribed Burning

All prescribed burns require an approved prescribed burn plan and must comply with the Clean Air Act and the Arkansas Voluntary Smoke Management Program. (<http://www.frames.gov/rcs/13000/13888.html>).

Agency requirements for conducting prescribed burns identify specific weather conditions (parameters) that must be met prior to burning. Planning efforts include picking wind directions to avoid negatively impacting smoke sensitive sites and notifying the public of impending burns. Simple smoke screening is done to determine potential downwind impacts. (A model for simple smoke screening can be found at <http://shrmc.ggy.uga.edu/smoke/>).

Other more complex models such as VSMOKE (<http://webcam.srs.fs.fed.us/tools/vsmoke/index.shtml>) and HYSPLIT (<http://www.arl.noaa.gov/ready/hysplit4.html>) are used to model smoke from planned prescribed burns.

The Arkansas-Oklahoma Interagency Coordination Center (AOICC) provides detailed mapping and tables of information for each planned Forest Service burn. ([http://www.fs.fed.us/r8/ouachita/fire/index\\_aoicc.shtml](http://www.fs.fed.us/r8/ouachita/fire/index_aoicc.shtml)).

Archived tables of prescribed burn locations, sizes, and names can be found at ([http://www.fs.fed.us/r8/ouachita/fire/rx\\_information\\_archive.shtml](http://www.fs.fed.us/r8/ouachita/fire/rx_information_archive.shtml)).

A toll free number is provided (1-888-243-1042) with daily messages detailing who is burning and location of the burn. Additionally, individual Ranger Districts maintain a “call-up” list of people wanting to be notified of local prescribed burns. Media (newspapers and radio), sheriff’s departments, and volunteer fire departments are also contacted prior to burning.

Smoke is monitored at near real-time through use of websites such as (<http://adds.aviationweather.gov/satellite/>) and (<http://www.firedetect.noaa.gov/viewer.htm>). Archived smoke plumes as detected from satellites from prescribed burns and other federal and non-federal sources (including wildfires) can be found via use of NOAA's website above.

Real-time ambient monitoring can be done via the use of (<http://www.airnow.gov/>), or when available, real-time reading from EBAM or E-Sampler PM<sub>2.5</sub> monitors. Archived emissions monitoring information can be extracted from these sites also.

Visibility monitoring is done using aircraft during burns or sometimes via webcams found at sites such as: (<http://www.fsvisimages.com/upbu1/upbu1.html>) or (<http://www.wunderground.com/webcams/index.html>).

There were very few smoke-related incidents attributable to Forest Service prescribed burning between October 1, 2008 and October 1, 2014. Smoke impacts for these incidents were moderate in intensity and short-lived, lasting only a few hours. While not all the smoke that affected communities came from Forest Service burning, it is probable that some did.

During the monitoring period, no prescribed burns conducted by the Forest Service are known to have negatively affected any regulatory-related federal or state smoke monitors contributing to higher-than-average hourly or daily PM<sub>2.5</sub> emissions.

Fire Management activities across the OSFNFs are relatively stable with a general trend of 15 to 30 wildfires occurring annually burning an average of 792 acres in the past 7 years (Table 19), with the majority of those being human caused. Lightning activity as a source of fire ignition plays an important but relatively small role in fire cause.

**Table 19. Acres of Wildland Fires on the OSFNFs from 2008 – 2014**

Objective or Activity	Unit of Measure	2008	2009	2010	2011	2012	2013	2014
Wildland Fire	Acres	285	1,221	273	626	2,459	309	374

The objective to treat 50,000 to 100,000 acres of the OSFNFs with prescribed fire for hazardous fuels reduction is usually reached (Table 20). However, this does not achieve the level to treat the management areas or communities with the return frequency desired. All opportunities to increase treatments are utilized. Through partnering with the state agencies, non-government organizations, and private land owners through agreements, landscapes and benefits are being achieved on a landscape scale crossing agency boundaries. Treatment activities across the Forests to move landscapes toward desired conditions through prescribed burning, mechanical methods, and integrated activities have remained fairly constant the last few years. We would expect this trend to continue.

**Table 20. Acres of Prescribed Fire on the OSFNFs from 2008 – 2014.**

Objective or Activity	Unit of Measure	2008	2009	2010	2011	2012	2013	2014
Prescribed Fire	Acres	63,376	53,140	65,058	38,351	51,879	47,006	32,985

Effects of the fuels treatment program has resulted in gains toward restoration of ecosystems, reduction in risk of unwanted wildfires, and wildlife habitat improvement. Legal mandates, congressional intent expressed in annual budgets, natural disturbance events, and other issues or factors beyond the control of the fire program all influence performance. Opportunity to move toward desired conditions through the management of wildfires for multiple objectives has been increased.

At the time the RLRMP was approved, wildland fire was a general term describing any non-structure fire that occurs in the wildland. Wildland fire was categorized into three types:

- **Wildfire** – Unplanned ignitions or prescribed fires declared a wildfire. All wildfires had to be managed with the single objective of controlling/confining the fire so as to provide protection to public and firefighters, and limit damages to the extent possible.
- **Fire Use Fires** – Unplanned ignitions ignited from natural sources managed to achieve resource benefit objectives.
- **Prescribed Fires** – Planned ignitions to achieve resource goals, objectives, and benefits.

On February 13, 2009, the Fire Executive Council (FEC) approved guidance for implementation of federal wildland fire management policy. By direction of the Wildland Fire Leadership Council, this guidance provides for consistent implementation of the *Review and Update of the 1995 Federal Wildland Fire Management Policy* (January 2001). The guidance still defines wildland fire as a general term describing any non-structure fire that occurs in the wildland, however, the policy now directs that only two categories of wildland fire exist.

- **Wildfires** – Unplanned ignitions and prescribed fires declared a wildfire.
- **Prescribed Fires** – Planned ignitions.

Furthermore, it clarifies, directs, and recognizes that:

- A wildfire can be managed for more than one objective,
- Objectives can change as the fire spreads, and
- Objectives are affected by changes in fuels, weather, topography, and involvement of other government jurisdictions having differing missions and objectives.



All responses to wildland fire are based on objectives and constraints in the RLRMP.

Two design criteria in the RLRMP are:

- Forest-Wide Standard 162 which permits fire use,
- Management Area Standard MA1.A-13 which prohibits the use of prescribed fire in wilderness.

The RLRMP priorities for fire suppression strategy are to:

- Suppress wildfire at a minimum cost providing for firefighter and public safety while considering benefits as well as values at risk,
- Use a full range of suppression tactics consistent with forest and resource management objectives and direction, and
- Manage natural ignitions to accomplish resource management objectives, as outlined in the Fire Management Plan except in Wilderness (RLRMP p. 2-26).

It is reasonable to assume that since the RLRMP permitted Fire Use, managing wildfires for multiple objectives will also be permissible. It is recommended to include a short statement to add clarity to these changes in policy and wildfire categories. “Due to changing guidance and national policy, wildfires occurring in Forest Management Areas that allowed Fire Use will be managed following the most up-to-date guidance for implementing wildland fire management policy.”

## **SMOKE**

Wildland and prescribed fires produce smoke. Smoke from prescribed burning is a problem when it creates an annoyance, nuisance, or negatively affects human health and safety. Managing smoke production from prescribed fires is one of the biggest challenges for fire managers. Through scientific modeling and developed smoke management guidelines, we are able to predict smoke production. Additionally, smoke production is monitored capturing particulate matter 2.5 (PM<sub>2.5</sub>) measurements using portable real-time beta gauge monitors traceable to EPA requirements. Two portable Environmental Beta Attenuation Mass Monitors (EBAMs) are used across the Forests to gather real time information pre-burn, during burns, and post burns.

To manage impacts of smoke, the Forests have agreed through regional guidelines to follow Arkansas’ State Department of Environmental Quality smoke guidelines in the planning and implementation of prescribed burns. The guidelines use reference weather data to determine a daily category rating (allowable smoke production) for each air shed in which a prescribed burn is being conducted. The total number of acres allowed to be burned each day in an air shed is based on fuel loadings and fuel types. Regional Prescribed Fire Manual guidance allowed for variance waivers to the state guidelines, as the state’s position was that we were voluntarily following the guidelines, and they had no jurisdiction. In previous years, this



amounted to about 10% of prescribed burns being conducted with regional waiver approval. The Regional Forester plans to delegate the waiver process to the Forest Supervisor level.

Prescribed burning to manage wildlife habitat improvement, vegetation for restoration, fuel reduction, and health and safety for employees and the public is a common and accepted practice.

## **Emission**

Existing emission sources occurring within the project area consist mainly of mobile sources. These include, but are not limited to, combustion engines, dust from unpaved surfaces, and smoke from prescribed (federal, local, county) burning.

The primary means of ascertaining dispersion direction and projected PM<sub>2.5</sub> (Particulate Matter in the air 2.5 micrometers or less in size) concentration levels on the Ozark National Forest today is known as HYSPLIT (Hybrid Single-Particle Lagrangian Trajectory). HYSPLIT is a web-based model that combines forecast data, emissions, and heat release rates to estimate downwind pollutant concentration levels. The level of concentration of PM<sub>2.5</sub> becomes increasingly relevant in relation to the pollutant's proximity to population centers, Class I areas, or non-attainment areas.

The purpose of utilizing a program of this nature is to assure adherence to air quality standards and to manage smoke from prescribed fire to keep the smoke's impact on people and the environment within acceptable limits. The Environmental Protection Agency (EPA) has reported that fine particles (2.5 micrometers or smaller) have the potential to impair human health when people are exposed to high levels. The fine particles that can impair human health can also reduce visibility in federally-mandated Class I areas such as Caney Creek Wilderness Area and Upper Buffalo Wilderness Area where regulations have been implemented to make reasonable progress at removing any human impairment of visibility. Prescribed fire managers are using HYSPLIT to predict and subsequently limit public safety hazards posed by smoke intrusion into populated areas, prevent deterioration of air quality, prevent National Ambient Air Quality Standards (NAAQS) violations, and prevent visibility impairment at Class I areas and other smoke-sensitive areas.

The Clean Air Act requires the EPA to establish NAAQS for six pollutants considered harmful to public health and the environment: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. The standards were set at the level required to provide an ample margin of safety to protect the public health. An attainment area is a geographic area in which levels of criteria air pollutant meet NAAQS for the pollutant. Under the CAA, any area that violates NAAQS for any of the six criteria pollutants as few times as once per year and as often as four times over a three-year period is classified as a "nonattainment" area. The project area lies within Madison County Arkansas. Currently, the levels of all six criteria pollutants are at or below the NAAQS (attainment) in this county.

## **Direct and Indirect Effects**

### **Alternative 1**

There would be no substantial changes to present air quality. Exhaust emissions and dust from vehicles passing through the project area would continue. Occasionally, local residents burning trash and small brush piles would generate smoke.

## **Alternative 2**

Prescribed burning will have the potential to impact local and regional air quality. The area immediately downwind will have the greatest chances for impacts. Risks include respiratory damage and temporary impairment of visibility. The Final Environment Impact Statement (FEIS p. 3-62) indicates particulate matter may exceed the EPA 24-hour standard for short periods of time. The management guidelines within the site-specific burning plan will mitigate this effect in the immediate vicinity and downwind from it.

With respect to air quality, the greatest potential for effect will be caused by prescribed burning. Short-term changes to the current air quality condition, including contributions to the greenhouse concentration of gases in the atmosphere, will result from the prescribed burning in the project. The burning will be conducted in accordance with a prescribed burn plan when conditions are favorable for rapid smoke dispersal. Arkansas Smoke Management Guidelines will be observed. Because residual smoke flows and settles in low areas during the night and early morning and may contribute to heavy fog formation which creates hazardous road conditions, the burn activities will generally be completed by mid-afternoon so that most smoke is dispersed by nightfall. Individual ignitions will typically not exceed 3,000-3,500 acres daily. Prescribed burning of the project area may be spread over multiple years, therefore, reducing potential for smoke impacts. Use of aerial ignition will serve to reduce burn-out time and associated duration of smoke impacts. Aerial ignition will also help develop smoke column lifting and reduction of smoke impacts.

The direct effects of prescribed burning on air quality will include temporary increases in particulate matter and carbon monoxide concentrations, eye, nose and throat irritations, decreased visibility along travel ways, and odor/nuisance of smoke. Smoke consists of small particles (particulate) of ash, partly consumed fuel, and liquid droplets. Other combustion products include invisible gases such as small quantities of nitrogen oxides. Oxides of nitrogen are usually produced at temperatures only reached in piled or windrowed slash or in very intense wildfires. In general, prescribed fires produce inconsequential amounts of these gases. Except for organic soils (which are not typically consumed in prescribed burns), forest fuels contain very little sulfur, so oxides of sulfur are not a problem (USDA Technical Publication R8-TP11). Persons near the actual burn area might receive some respiratory discomfort; however, it is expected that most impacts will be in the form of nuisance smoke and/or smell. Smoke from the prescribed burning and the associated emissions will reside in the local area a relatively short time depending on the weather. Signs will be needed along public roads to warn the public of smoky conditions. Smoke trapped in low-lying areas will be expected to dissipate once morning temperatures rise and the nighttime inversion lifts.

Other primary products of combustion are water vapor, particulate matter, hydrocarbons, carbon monoxide, polyaromatic hydrocarbons, and trace minerals. Carbon monoxide and particulate matter are EPA criteria pollutants. Polyaromatic hydrocarbons are listed as toxic substances. Strict adherence to RLRMP guidelines and a site-specific burning plan will limit the area where EPA standards are exceeded to a location very close in proximity to the flaming front. The burn plan will ensure that smoke or other combustion products do not

reach smoke sensitive areas. Monitoring during and after the burns for adherence to guidelines and/or any potential problem areas will be conducted. These actions will ensure that the requirements of the Clean Air Act, EPA air standards, and state requirements are met and there should be no long-term cumulative effects from these burns.

An indirect effect of prescribed burning is a reduction in the emissions that will be released from potential wildfires in the area. By removing the small diameter surface fuels with a controlled low-intensity prescribed fire, the potential of a high-intensity catastrophic fire developing within the stands will be reduced substantially. If a wildfire were to occur and reach into the crown canopy, the amount of live fuel that could burn will tend to release high amounts of particulate matter.

Table 21 lists the estimated amounts of CO<sub>2</sub> resulting from the prescribed burning with implementing the selected action. The organic matter consumed will be replaced by new vegetation so that there should be little net increase in the carbon dioxide in the atmosphere (Dipert 1992:2 draft/unpublished).

**Table 21.** Daily total emissions released during Alt. site prep, thinning, WL, TSI, and hazardous fuel reduction prescribed burning.

Compound Emitted	Estimated Release (U.S. Tons)*
	Alternative 2
Carbon Dioxide (CO <sub>2</sub> )	13,042
Carbon Monoxide (CO)	1,356
Water Vapor	5,187
Particulate Matter	522
Hydrocarbons	130
Nitrogen Oxides	24
<b>TOTAL</b>	<b>20,261</b>

\*Estimates of coefficients used for calculations: a) 2.25 tons/ac actually consumed in hazardous fuel reduction burns in non-harvested areas; 4.5 t/ac burned in thinning areas; 5.0 t/ac burned in shelterwood areas; 5.4t/ac in seedtree areas (Representative of fuel models in the Prescribed Fire Guide for the Southern Region). b) 2,000-3,000 lbs of CO<sub>2</sub> emitted/ton of fuel burned (Dipert, 1992).

Approximately 3,800 acres/burn-day is analyzed in this model over four burn-days. Potentially, under Alternative 2, a total of 15,206 acres can be burned (12,706 acres of National Forest and approximately 2,500 acres of private land). A figure of 625 acres of private ownership is assumed to be burned per day under this model. These lands may or may not be burned, depending on private landowner cooperation with National Forest prescribed burning agreements. So, the figure listed in the **TOTAL** column above is tons released in one burn-day of 3,800 acres. Considering all of the scattered private land and the drainage configuration, an amount of 500-1,500 acres per burn-day is more realistic. The mid-section of the Brushy Mountain project area and to its northeast portion hold the most potential for larger scale burning due to fewer areas of private land; but, again the drainage pattern may be a hindrance that restricts the burning to that figure of 500-1,000 acres/burn-day. Ultimately, the 3,800 acres of burning per day and its predicted emissions are conservatively overestimated.

### **Cumulative Effects**

The global effects of prescribed burning are discussed in the VMEIS. The effect of prescribed burning on climate change is dependent on a pool of knowledge yet to be formulated.

Air quality from implementation of the prescribed burning will not be affected by any past burns in the area or by any future burns on the District because once the smoke has dispersed, the emissions are diluted and removed from local airsheds.

For air quality, cumulative effects include all reasonable and foreseeable activities that produce pollutants. Emissions from prescribed burning and from vehicles and machinery during management activities will contribute greenhouse gases and pollutants to the atmosphere, but the volume of these emissions will be inconsequential and are not expected to have a cumulative impact on current air quality.

## **5. Herbicides**

### **Existing Condition**

Herbicide use is an important tool for benefiting oak/pine regeneration by providing for these species presence in the ecosystem in the long-term. Effects of herbicide toxicity data and dosage estimates for Triclopyr, Imazapic, Imazapyr, Glyphosate and Hexazinone selected for use in alternative 2 indicate that there is only a very low risk to wildlife, both from realistic and extreme exposures. Monitoring for herbicide concentrations following use has been a continuous policy of the OSFNFs. Monitoring results have not documented any significant on-site concentrations of herbicides or off-site movement. In a study regarding the use of herbicides in forestry applications (Michael, 2001), the author found that maximum pesticide concentrations observed in water have been much lower than the maximum levels which the Environmental Protection Agency (EPA) considers safe for consumption on a daily basis over a lifetime (Health Advisory Level-HAL). In some studies the author reviewed maximum herbicide concentrations observed in ephemeral to first-order streams exceeded the lifetime HAL, but found that they last only a few hours and the highest concentrations did not exceed EPA's 1-day HAL.

Even with the widespread use of pesticides in North America, those typically used in forestry vegetation management programs have not been identified in surface or ground water at sufficiently high concentrations to impair drinking water quality. Their rapid break-down by physical, chemical, and biological routes coupled with current use patterns precludes the development of significant water contamination problems unless they are applied directly to water. Additionally, mitigation measures normally employed through BMPs further restrict herbicide's effects outside the boundaries of its application. On August 27 and 28, 2014, analysis of risk was performed for the chemicals; Glyphosate, Hexazinone, Imazapic, Imazapyr, Triclopyr amine, and Triclopyr ester at the proposed rate of application in SERA risk assessments prepared for the USDA Forest Service (SERA 2004, 2005, and 2011). Worksheets associated with the SERA risk assessments were completed for all proposed chemicals. When required, application rates for each chemical were tailored to typical District use rates. In some instances, the standard application rate as modeled in the SERA worksheets was utilized when it was similar to typical District use rates.

In a variety of human health and environmental health scenarios (including a variety of wildlife scenarios) most HQs were projected to be below the Forests' maximum acceptable standard of 1. Application of mitigation measures shown previously in this document and adherence to Forest Standards for herbicide use and chemical labels for application will negate HQs > 1 related to drift, accidental spills, run-off and applicator (worker) exposure. Parameters and output from these analyses are available as part of the process record at the Pleasant Hill Ranger District Office, 2591 Highway 21, Clarksville, Arkansas 72830.

**Glyphosate** is not soil active and has low toxicity to animals. Glyphosate: when contacting eyes is no more than slightly irritating based on toxicity studies; with skin contact is not more than slightly toxic and not more than slightly irritating based upon toxicity studies; when ingested is no more than slightly toxic based on toxicity studies – with no significant adverse health effects expected if only small amounts (less than a mouthful) are swallowed; when inhaled is no more than slightly toxic based on toxicity studies (MSDS for Foresters' Non-Selective Herbicide dated 11/26/2008). Lab studies conducted specifically on bobwhite quail also demonstrate extremely low toxicity.

Worksheets for Human Health and Ecological Risk Assessments for the chemical Glyphosate (SERA, 2010) were used to determine HQs for workers, the general public and wildlife. All HQs for humans and terrestrial wildlife are less than 1.0. HQs for many aquatic species are greater than 1 (see Process Record for specific numbers). These higher HQs (suggesting risk to these species) were modeled from accidental chemical spills into aquatic environments. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use, adherence to BMPs and adherence to application instructions on chemical labels will negate HQs > 1.

**Hexazinone** is soil active, and if not applied correctly has the ability to move off site. Use of chemical label application rates and application methods, Forest-Wide Standards and BMPs mitigates this potential.

Contact with Hexazinone may cause corneal opacity or clouding of the eye and skin irritation/rash on the skin. Based on animal data, ingestion of large amounts of Hexazinone may cause effects on the liver. Significant skin permeation and systemic toxicity after contact appears unlikely (MSDS for Velpar L dated 11/4/2010). Hexazinone is practically non-toxic to fish, fresh water invertebrates and mollusks, and is slightly toxic to crustaceans. When Hexazinone is ingested by animals, it is broken down into metabolites which are rapidly excreted in the urine and feces. Hexazinone does not accumulate in the tissues of exposed animals (USDA 2012).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Hexazinone (SERA 2006) were used to determine HQs for workers, the general public and wildlife. All HQs for workers (herbicide applicators) are less than 1; with the exception of HQs modeled for application of upper level field solution concentrations (see process record for specific numbers). These upper level field solution concentrations are not used on the District. This negates these HQs > 1.

All HQs for the general public related to use of granular formulations of Hexazinone were less than 1.

All HQs for the general public related to use of liquid formulations of Hexazinone were less than 1, with the exception of use of upper level field solution concentrations causing HQs > 1.0 for adult females consuming contaminated fruit and contaminated vegetation (see process record for specific numbers). Also, modeling of central level field solution concentrations caused a HQ > 1 for adult females consuming contaminated vegetation (see process record for specific numbers). These HQs > 1 are not of concern for the following reasons:

- The scenario modeled assumes contaminated vegetation/fruit is consumed by the individual for 90 days.
- Contaminated vegetation will show signs of stress/mortality before the termination of this 90-day period, thereby discouraging an individual from eating it.
- The scenario assumes that Hexazinone is applied to the foliage/fruit of vegetation. Soil application of this chemical is utilized on the District, not foliar spray application.

All HQs for wildlife related to use of granular formulations of Hexazinone were less than 1, with the exception of HQs for some aquatic organisms (see process record for specific numbers). These higher HQs (suggesting risk to these organisms) were modeled from accidental chemical spills into aquatic environments, and movement of higher field solution concentrations of this chemical off-site into aquatic environments. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use, adherence to BMPs and adherence to application instructions on chemical labels will negate HQs > 1.

All HQs for wildlife related to use of liquid formulations of Hexazinone were less than 1, with the exception of the HQs for long-term exposure of a large mammal on site, and with the exception of HQs for some aquatic organisms (see process record for specific numbers). These HQs > 1 are not of concern for the following reasons:

- The scenario assumes a diet composed of 100% contaminated vegetation or insects from the treated site which is highly unlikely.
- The long-term HQ assumes that vegetation is consumed on the same site for 90 days which is also unlikely.

Higher HQs (suggesting risk to some aquatic organisms) were modeled from accidental chemical spills into aquatic environments, and movement of higher field solution concentrations of this chemical off-site into aquatic environments (see process record for specific numbers). Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use and adherence to application instructions on chemical labels will negate HQs > 1.

**Imazapic** is weakly adsorbed in basic soils, but adsorption increases in acidic soils. Field studies have not shown movement of this chemical in surface water. This herbicide has low toxicity to animals. There is a high probability that Imazapic is not acutely harmful to

aquatic invertebrates, aquatic plants or fish. In addition, this chemical is non-irritating with exposure to skin and eyes (MSDS for Plateau dated 3/5/2012).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Imazapic (SERA 2006) were used to determine HQs for workers, the general public and wildlife. All HQs for humans and terrestrial wildlife are less than 1. HQs for some aquatic organisms are greater than 1 (see process record for specific numbers). These higher HQs (suggesting risk to these species) were modeled from accidental chemical spills into aquatic environments. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use, adherence to BMPs and adherence to application instructions on chemical labels will negate HQs > 1.

**Imazapyr** is soil active, but mobility in soil is relatively low. It can be soil active particularly during spring leaf expansion. Application after mid-September may yield soil activity the following spring. This chemical has very low toxicity to mammals or other animals. It may cause slight but temporary irritation to the eyes and skin if exposure occurs (MSDS for Arsenal AC dated 6/15/2009).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Imazapyr (SERA 2011) were used to determine HQs for workers, the general public and wildlife. All HQs for humans and terrestrial wildlife are less than 1. HQs for some aquatic organisms are greater than 1 (see process record for specific numbers). These higher HQs (suggesting risk to these species) were modeled from generally central and upper field solution concentrations representing both accidental and deliberate exposure to the chemical and long-term exposure. Forest-Wide Standards preclude application of herbicide not labeled for aquatic use near of within aquatic environments. Application of mitigation measures, adherence to Forest-Wide Standards for herbicide use, adherence to BMPs and adherence to application instructions on chemical labels will negate HQs > 1 for aquatic organisms.

Non-targeted plants which are also non-tolerant to this chemical, could be killed if they are within close proximity to targeted plants. This could indirectly affect habitat for wildlife on a small scale. However, the majority of application of this herbicide is through the cut surface or hack and squirt application methods – not foliar spraying. Therefore, the typical application method used for this chemical greatly limits the amount of non-target plant mortality.

**Triclopyr Amine** and **Triclopyr Ester** are not soil active, except in examples of spills or misapplications not in accordance with label application rates. These chemicals have low bioconcentration potential and single dose toxicity to mammals is low although prolonged or repeated exposure may cause skin in mammals and irritation corneal damage if introduced into the eyes (MSDS for Element 3A Herbicide dated 5/25/2011).

Worksheets for Human Health and Ecological Risk Assessments for the chemical Triclopyr (USDA 2011) were used to determine HQs for workers, the general public and wildlife. Both ester and amine formulations of this chemical were investigated.

All HQs for workers (handling herbicide) related to use of Triclopyr amine and ester formulations were less than 1, with the exception of use of upper level field solution concentrations causing HQs > 1 for workers with contaminated gloves worn for more than

one hour when applying the ester formulation (see process record for specific numbers). This upper bound HQ will be mitigated by changing protective clothing and washing following contamination as directed by policy.

HQs for workers associated with chronic exposure (repeated long-term) are  $\geq 1$  for broadcast spray applications of Triclopyr amine and  $> 1$  for backpack and broadcast spray applications of triclopyr ester – all at the upper application level field solution concentrations (see process record for specific numbers).

Modeling shows that some workers applying Triclopyr ester at the modeled application rate of .48 lb. a.e./acre will be subject to exposures that exceed a HQ of 1, by a substantial margin. These HQs  $> 1$  for workers – taken from very conservative modeling are tempered by the following:

- Overt toxic effects in workers do not appear to be likely. There are no epidemiology studies or case reports which suggest that systemic toxic effects are associated with occupational or even accidental exposures to any form of Triclopyr; furthermore, no poisoning reports involving any form of Triclopyr are documented in the reasonably comprehensive summary of human case reports on pesticide exposures by Hayes (1982).

HQs for the general public are  $> 1$  for situations modeled from accidental spills of Triclopyr amine into small ponds with the water consumed by a child (see process record for specific numbers). These upper bound HQs are derived from spillage of the upper application level of field solution concentrations for both foliar application and hack and squirt application. The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed upon use of herbicides near water.

- Adherence to Forest Plan Standard FW30. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas.
- Adherence to Forest Plan Standard FW32. Herbicide will not be used within the appropriate SMZs (streamside management zones) or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a “Finding of No Significant Impact” (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas.

HQs for the general public are  $\geq 1$  for non-accidental acute exposure (single exposure) for both Triclopyr amine and ester formulations for adult female consumption of contaminated fruit, and skin contact with contaminated vegetation. These HQs are associated with both the central and upper application levels of field solution concentrations (see process record for specific numbers). These HQs  $> 1$  for the general public – taken from very conservative modeling are tempered by the following:

- The modeling assumes that the adult female walks through an area shortly after treatment (vegetation still wet), wearing shorts. In most cases, herbicides are



applied in relatively remote areas, and so it is not likely that members of the general public will be exposed to contaminated plants shortly after treatment (SERA 2007). This general exposure scenario for the general public may be implausible or at least extremely conservative.

- For contaminated fruit, the exposure scenario assumes that an area of edible plants is inadvertently sprayed. While such inadvertent contamination might occur, it is extremely unlikely to happen as a result of directed applications (backpack or broadcast applications). In all spraying scenarios, the possibility of inadvertent contamination of cultivated or edible vegetation will be low. For herbicides, it is likely that the contaminated plants will show obvious signs of damage over a relatively short period of time and will, therefore, not be consumed (SERA 2007).
- The typical hazard to the general public may often be negligible because significant levels of exposure are not likely. For the general public, the general exposures may be regarded as extreme in that they are based on very conservative exposure assessments and/or very implausible events. These general exposure assessments are included because the risk assessment is intended to be extremely conservative with respect to potential effects on the general public (SERA 2007).

HQs for the general public are  $\geq 1$  for chronic/longer-term exposures for both Triclopyr amine and ester formulations for adult female consumption of contaminated fruit and vegetation. These HQs are associated with only the upper application levels of field solution concentrations (see process record for specific numbers). These HQs  $> 1$  for the general public – taken from very conservative modeling are tempered by the following:

- The exposure scenarios based on longer-term consumption of contaminated fruit and vegetation assume that an area of edible plants is inadvertently sprayed and that these plants are consumed by an individual over a 90-day period. With herbicide use, it is likely that the contaminated plants will show obvious signs of damage over a relatively short period of time and will, therefore, not be consumed (SERA 2007).
- The amount of non-target vegetation subject to spray deposition is small. The average half-life of this chemical is 30 days; degraded by both soil microbes and photolysis. The concern that humans will eat contaminated vegetation for 90 days in field conditions is further reduced by the average half-life of this chemical.
- Herbicide treatments occur on an infrequent basis in project areas – with applications usually separated by multiple years.
- The typical hazard to the general public may often be negligible because significant levels of exposure are not likely. For the general public, the general exposures may be regarded as extreme in that they are based on very conservative exposure assessments and/or very implausible events. These general exposure assessments are included because the risk assessment is intended to be extremely conservative with respect to potential effects on the general public (SERA 2007).

HQs for terrestrial animals are  $> 1$  for situations modeled from accidental spills of Triclopyr amine into small ponds. In these scenarios the contaminated water is consumed by a large mammal, and fish from the contaminated water are consumed by a large mammalian carnivore and a canid. These upper bound HQs are derived from spillage of the upper application level of field solution concentrations for hack and squirt application where a higher concentration of chemical is used (see process record for specific numbers). The plausibility of scenarios which result in spills of chemical into water is reduced by restrictions placed upon use of herbicides near water.

- Adherence to Forest Plan Standard FW30. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas.
- Adherence to Forest Plan Standard FW32. Herbicide will not be used within the appropriate SMZs (streamside management zones) or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent significant environmental damage such as noxious weed infestations supports a “Finding of No Significant Impact” (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas.

HQs for terrestrial animals are  $\geq 1$  for scenarios modeled from some mammals and birds consuming contaminated vegetation with high residue rates, and some instances of large mammals and small birds consuming contaminated fruit with low residue rates. These HQs are associated with both the central and upper application levels of field solution concentrations (see process record for specific numbers). These HQs  $\geq 1$  for terrestrial wildlife – taken from very conservative modeling are tempered by the following:

- For both the acute and chronic exposure scenarios, the assumption is made that 100% of the diet is contaminated. This may not be a realistic assumption for some acute exposures and will probably be a rare event in chronic exposures—i.e., animals may move in and out of the treated areas (SERA 2011).
- Chronic HQs assume that vegetation is consumed on the contaminated site for 90 days. This general, chronic exposure scenario for terrestrial wildlife may be implausible or at least extremely conservative.
- The amount of non-target vegetation subject to spray deposition is small. The average half-life of this chemical is 30 days; degraded by both soil microbes and photolysis. The concern that humans will eat contaminated vegetation for 90 days in field conditions is further reduced by the average half-life of this chemical.
- Herbicide treatments occur on an infrequent basis in project areas – with applications usually separated by multiple years.

As reviewed in U.S. EPA/OPP (2009a, p. 82 ff) and detailed in Appendix O of the EPA risk assessment, the U.S. EPA/OPP maintains a database of ecological incidents associated with

pesticide applications. A total of 63 incidents regarding Triclopyr applications were reported to the EPA. None of these incidents reported adverse effects in mammals. As summarized in Appendix 2, Table A2-10, of the (SERA, 2011) Triclopyr risk assessment, none of the available field studies associate adverse effects in mammals with the direct toxicity of Triclopyr (SERA, 2011).

Two general factors may contribute to the apparent discrepancy between the high HQs for Triclopyr and the lack of reported adverse effects in field studies or incident reports. Like the human health risk assessment, the ecological risk assessment uses the extreme value approach. The upper bound HQs represent multiple worst case exposure assumptions that may not occur frequently in the field. Also, the field study by Leslie et al. (1996) suggests that some mammals, such as deer, may avoid treated areas. As discussed in the exposure assessment, the scenarios for the consumption of contaminated vegetation assume that 100% of the diet is contaminated. If larger mammals avoid treated areas, the proportion of the contaminated diet could be much less than 100%. As the proportion of the diet that is contaminated decreases, the consequent HQs will also decrease (SERA 2011).

HQs are  $\geq 1$  for scenarios modeled for some aquatic organisms. These upper bounds HQs are associated primarily with scenarios involving accidental acute exposure (one time exposure through a spill), a few through non-accidental acute exposure (one time exposure through direct spraying) and a few through chronic/longer-term exposure. These HQs are associated with both the lower, central and upper application levels of field solution concentrations, depending upon the sensitivity of the species (see process record for specific numbers). These HQs  $\geq 1$  for aquatic organisms – taken from very conservative modeling are tempered by the following:

- Neither terrestrial nor aquatic applications of Triclopyr amine pose substantial risks to aquatic animals across the range of labeled application rates. Triclopyr ester, however, is much more toxic than Triclopyr amine to aquatic animals. At application rates in excess of about 3 lb a.e./acre, peak concentrations of Triclopyr ester in surface water could pose acute risks to sensitive species of fish and aquatic phase amphibians. Similarly, acute risks to sensitive species of aquatic invertebrates could occur if application rates exceed about 1.5 lb a.e./acre (SERA 2011). The typical District application rates of .36 - .48 lb/acre is much less than this. The likelihood of acute risks to aquatic animals depends very much on site-specific conditions. In areas with low rates of rainfall, acute risks to aquatic animals will be negligible, so long as drift to surface water were minimal. In areas with high rates of rainfall, the surface water contamination is more likely (SERA 2011).
- Adherence to Forest Plan Standard FW30 will minimize possibilities of spills of concentrated chemical entering water. Herbicide mixing, loading, or cleaning areas in the field are not located within 300 feet of private lands, open water or wells, or other sensitive areas (USDA, 2005).
- Adherence to Forest Plan Standard FW32 will minimize possibilities of herbicide drift to surface waters. Herbicide will not be used within the appropriate SMZs or within 300 feet of any public or domestic water intake. Selective treatments may occur within SMZs only when a site-specific analysis of actions to prevent

significant environmental damage such as noxious weed infestations supports a “Finding of No Significant Impact” (FONSI), and then using only herbicides labeled for both terrestrial and aquatic use within these areas (USDA, 2005).

- Adherence to Arkansas Forestry Best Practices for Water Quality Protection 7.15 – precludes chemical application immediately before precipitation, or after a rain if there is still runoff. Upcoming storm predictions are utilized to time chemical application (AFC, 2002).

On occasion it is more effective for herbicides to be mixed together. For example, when trying to eradicate fescue, mixtures of Glyphosate and Imazapyr are recommended. Timber stands occasionally may require mixing Triclopyr and Imazapyr, or Glyphosate and Imazapyr to control red maple. Mixing these herbicides does not increase potential toxicity to humans or wildlife. Additionally, in order to improve the success of herbicide (foliar) applications, a surfactant (Cide-Kick, Cide-Kick II, JLB Oil Plus, JLB Oil and Red River 90) may be mixed with the above mentioned herbicides. These are non-ionic surfactants. They are added to aid the chemical in adhering to the leaf’s surface. As per Forest-Wide Standard FW20, diesel oil is prohibited from use as a carrier or surfactant (USDA, 2005).

Active ingredients for surfactants used by the District are:

- Red River 90 – Alkylarpolyoxethylene, glycols, and free fatty acids.
- Cide-Kick – D’limonene, related isomers, and emulsifiers (citrus oil)
- Cide-Kick II – D’limonene, related isomers, and emulsifiers (pine oil)
- JLB Oil Plus – vegetable and limonene oil
- JLB Oil – processed petroleum oil and limonene emulsifiers

Chemical composition of surfactants is innocuous. Surfactants do not increase potential toxicity to humans or wildlife. They assist herbicide in adhering to plant surfaces and/or penetrating the targeted surface of foliage.

### **Direct and Indirect Effects**

#### **Alternative 2**

Direct effects, occurring at time of application, to birds or large mammals are unlikely, since these species are likely to move from the area when project activities are implemented. Although direct effects to amphibians are more likely since contact with herbicide could be absorbed through the skin, amphibians are likely to be under logs, rocks or leaves, making direct contact (from spray) with chemicals less likely. Direct effects to other non-target plants occurring in these habitats could occur. Application methods, including directed application to target foliage or to freshly cut stumps/surfaces, will minimize the possibility of direct contamination to non-target species. The most plausible possible direct effects to humans will be to workers from continuing work in contaminated clothing. Proper handling and cleanliness of personal protective gear will mitigate this possibility. More implausible direct effects to the general public may occur through walking through recently treated (wet) vegetation in shorts and consuming contaminated fruit. Narrative (shown above) for HQs ≥

1 for non-accidental acute exposure (single exposure) for both Triclopyr (amine and ester formulations) and Hexazinone shows these situations are unlikely.

Direct and indirect effects from chemical spills of all herbicides analyzed - to humans, wildlife and plants are minimized by following proper mixing and handling procedures, Forest-Wide Standards and BMPs.

Adverse, indirect effects to management indicator species (MIS) and habitats treated with all chemicals are reduced given that applicators treat target plants only and field formulations contain diluted concentrations of chemical. Additionally, mitigation measures, BMPs and Forest-Wide Standards will be used.

### **Cumulative Effects**

There are likely to be few negative cumulative effects to humans, wildlife or plants over time as a result of implementing alternative 2. None of the herbicides selected for use will bio-accumulate or have lengthy half lives in the environment. Implementation of alternative 1 will not authorize use of herbicide other than that which has already been analyzed under a previous NEPA decision for maintenance of wildlife openings and abatement of NNIS.

Related to cumulative impacts, the Pleasant Hill Ranger District is authorized under a previous NEPA analysis to apply herbicide district-wide on up to 500 acres annually to treat NNIS. Realistically, for the reasonably foreseeable future this may amount to 200 acres of herbicide treatment in the analysis area for NNIS over the next 5 years. In addition, no other herbicide projects are known from the Ozark National Forest or the vicinity at present, though some herbicide use is likely to occur on private lands particularly in association with agricultural production. Efforts to maintain early seral habitat and restore herbaceous species biodiversity in woodlands, and TSI treatments to benefit hard mast producing species are also likely to cumulatively benefit associated MIS species.

Per District policy, Imazapyr will be used on a limited basis and only at 10% solution or less. The past and selected use of herbicides will have no plausible negative direct, indirect or cumulative effects on humans, water quality or wildlife with adherence to Forest-Wide Standards FW19 - FW32 (USDA, 2005), application and mixing guidelines from chemical labels, herbicide mitigation measures and BMPs. Herbicide use will have beneficial effects on species using early-successional habitat by allowing creation and maintenance of wildlife openings, reduction of overstory and midstory canopy in wildlife stand improvement (WSI) areas, and promoting oak and pine regeneration through TSI cultural practices.

## **6. Forest Improvements (Road Access):**

### **Existing Condition**

Approximately 98 miles of roads exist within and around the Brushy Mountain project area; county roads comprise approximately 21 miles around and within the project area. These roads are regularly maintained by the county and Forest Service. Existing road locations shown on the map have been identified using Global Positioning System (GPS) equipment. Currently, the total road density is 1.0 miles of road/square mile. Road density under National Forest jurisdiction is 4.8 miles/square mile.

## **Direct and Indirect Effects**

### **Alternative 1**

Primary arterial roads would be maintained at their current level. However, revenues from timber sales would not be generated to aid in road maintenance.

Several roads which are currently open would remain so and continue to be maintained on a regular basis with implementation of the “no action” alternative. These roads are currently classed as maintenance level 2 or 3 (open roads) and are maintained for the public to reach private residences or allow for administrative access. However, forest interior roads classified as maintenance level 1 (closed roads) in need of maintenance or rehabilitation would continue to erode and contribute to sedimentations of creeks and streams.

### **Alternative 2**

A transportation analysis was completed for this project to inform this environmental assessment. It identified and considered values associated with or impacted by the existing road system and all selected roadwork. Consideration was given to long-term road funding opportunities and obligations.

Timber harvesting activities will require reconstruction and maintenance of open and closed roads. Descriptive statements of the road work that will be conducted are given on pages 22 through 25 of this Draft EA. Specific roadwork for alternative 2 is given in Table 11 and locations shown on the map. Locations of the roadwork were determined using GPS equipment. The effects of roadwork on soil erosion and water quality are considered in the Soil and Water sections and other effects in the Wildlife and Social sections of this EA.

All roads proposed for this project will average less than 10% slope, with some short sections slightly greater than 10%.

Maintenance on approximately 33.6 miles of open and closed roads will be performed in this project to get the roads in a suitable condition for hauling timber across them. Maintenance consists of spot blading and graveling. County roads that will be used are regularly maintained by their respective counties. Special cooperative agreements are in place to assist in any required maintenance resulting from logging operations. Several Maintenance Level 1 and 2 roads that were previously closed will be re-closed with gates/berms to reduce erosion and protect resources. The Forest Service Manual states that Maintenance Level 1 roads are to be closed to motorized traffic when management activities are complete.

Reconstruction on approximately 8.8 miles of roads will be implemented for: (1500, 1500A, 94411A, 94411H, 94412A, 94413A, 94413B, 94414H, 94415E, 94416H, 94417B, 94417C, 94418A, 94418B, 94417C, 94418A, 94418B, 94418F, and 94418N) These roads are not maintained on a regular basis thus requiring more work than the roads that require maintenance. Up-grading these roads by installing new culverts, wing-ditches, gravel, and rolling dips will stabilize them, thus minimizing sediment delivery to streams and drainages.

Approximately 18.6 miles of existing roads no longer needed for management or access will be decommissioned. Decommissioning involves restoring these roads by allowing them to blend back in to the general forest area. Activities used to decommission a road include, but are not limited to the following: re-establishing former drainage patterns, stabilizing slopes, restoring vegetation, blocking the entrance to the road, installing water bars (earthen mounds), and removing culverts. These activities are designed to completely eliminate the roadbed by restoring natural conditions. Unnamed and illegally accessed OHV trails that are present in the project area may be closed using debris, rocks, earthen mounds, or gates.

Approximately 4.4 miles of temporary roads will be needed to access timber stands. These roads will be blocked and rehabilitated with seeding and/or natural re-vegetation. Temporary roads are not intended to be included as part of the forest transportation system but rather managed for short-term projects or activities and will be decommissioned after use.

Gates will be installed on the short roads that access the new wildlife openings. This will amount to approximately 12 gates. Foot travel will still be invited on all roads in the project area.

An inventory of all existing roads was completed and locations were obtained using GPS equipment. Several unauthorized trails were identified as well as old road templates not presently being used for administration purposes. Some of these have been decommissioned and/or closed in the past, but are still being used as unauthorized OHV trails.

Very few special-use permits exist on Forest roads in the project area. However, it is fairly likely that the Forest Service will receive additional special-use proposals in the future to access private forest stands for commercial timber removal. The Forest Service will need to approach adjacent neighbors to work out agreements for accessing portions of the National Forest lands in this area.

### **Cumulative Effects**

The density of open roads will decrease under alternative 2 as all presently-closed Forest Service roads will not be re-closed upon completion of the project. Currently, total road density of Forest Service roads per square mile is about 4.8 miles length/mile<sup>2</sup>. Under Alternative 2, the road density decreases to 3.2.

The auditory and visibility impacts of road-using equipment should be relatively short-lived with very little effect on the environment. Re-closure and decommissioning of roads will reduce erosion and improve water quality in the project area.

Based on the watershed analysis that evaluates roads' contribution of erosion and sediment in these two alternatives, rates of delivery are considered low risk.

## **7. Heritage Resources**

### **Existing Condition**

The National Historic Preservation Act of 1966 (NHPA), as amended, requires federal agencies to take into account the effects of federal undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. Additionally, federal agencies are required to follow the implementing regulations of the ACHP set forth in 36 CFR Part 800. Specifically, 36 CFR Part 800 requires that State Historic Preservation Offices (SHPO) and federally-recognized Tribes be consulted about any undertaking that has the potential to affect historic properties and/or properties of religious or cultural significance at the earliest possible stage in the planning process. Protocols for cultural resource reviews, surveys, and reporting are specified by a Programmatic Agreement (PA) between the U.S. Forest Service, relevant federally-recognized Tribes, and SHPO of Arkansas and Oklahoma, signed in 2006 and extended in 2011, 2012, and 2013.

The Ozark-St. Francis National Forests are carved out of ancestral American Indian lands. American Indians' historical and spiritual connections to the land have not been extinguished despite changes in title. Respecting, honoring, accommodating, and protecting American Indian Sacred Sites is part of our commitment to restore forests and reserves.

A cultural resource review and inventory was conducted during the planning process for this project to identify historic properties. The findings of this survey are currently being written for reporting to the Arkansas SHPO and relevant-federally recognized Tribes as Project No. 16-10-04-01. Results are summarized below.

Much of the project area had been previously surveyed for cultural resources prior to planning for this project. Past surveys done for large Forest Service projects include the Barnes Project (PN 02-10-04-03) and Barron Creek Project (PN 97-10-04-13). There had also been surveys done by other agencies/contract firms for gas well projects and seismic lines. These earlier surveys resulted in the recording of 22 archeological sites within project boundaries. Fieldwork conducted in 2014, 2015, and 2016 for this project resulted in the recording of an additional 17 sites. In total, 39 known archeological sites are located within project boundaries. Distribution of sites by National Register eligibility recommendations and site types is shown below.

**Table 22. National Register Eligibility Recommendation and Site Type**

NR Eligibility	Site Types: Historic	Prehistoric	Multi- Component	Total
Eligible	2	9	1	11
Not Eligible	12	1	0	14
Undetermined	12	1	1	14
Total	26	11	2	39

Sites listed on the National Register of Historic Places, recommended eligible for nomination, and with undetermined eligibility will be protected from effects of activities by this project. Mitigation measures are discussed in detail in Chapter 2.

**Site Locations Not Yet Known.** Cultural resource surveys may not be complete for certain activities because additional planning may be required prior to implementation. These activities may include, but are not limited to:



- Burn boundary and fireline construction locations
- Temporary roads, skid trails, and log landings outside areas already surveyed
- Road reconstruction, maintenance, conversion, or decommissioning activities involving ground disturbance occurring outside areas already surveyed

These areas will be surveyed and consultation completed prior to implementation.

There may be American Indian sacred sites or landscapes currently unknown to the Forest Service. The Forest Service will continue to consult with our Tribal partners to ensure that American Indian sacred sites and landscapes are identified, assessed, and considered in project planning and implementation.

## **EFFECTS OF ALTERNATIVE 2**

The scope of the analysis for potential effects to cultural resources includes the entire project area and considers the activities within treatment areas, as well as access to these areas.

An effect to a cultural resource is the "...alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register." (36 CFR 800.16(i)) Any project implementation activity that has potential to disturb the ground has potential to directly affect archeological sites, as does the use of fire as a management tool. Specific activities outlined in the project that have potential to directly affect cultural resources include timber harvesting and associated log landings, skid trails and temporary roads, prescribed burning, and associated fireline construction, road maintenance or reconstruction where ground disturbance takes place outside existing right-of-way areas, and pond construction for wildlife water source.

Selected activities that do not have potential to affect cultural resources, and therefore, are not considered undertakings for purposes of this project include: Non-commercial thinning, timber stand improvements, on-going maintenance of existing Forest roads or reconstruction of previously surveyed roads where ground disturbance does not take place outside existing road prisms and existing drainage features, rehabilitation/closure of temporary roads, log landings, and skid trails using non-ground disturbing methods, road decommissioning using non-ground disturbing methods, and non-native invasive plant species control using non-ground disturbing methods.

In general, project activities have the potential to affect cultural resources by encouraging increased visitor use to those areas of the Forest in which cultural resources are located. Increased visitor use of an area in which archeological sites are located can render the sites vulnerable to both intentional and unintentional damage. Intentional damage can occur through unauthorized digging in archeological sites and unauthorized collecting of artifacts from sites. Unintentional damage can result from such activities as driving motorized vehicles across archeological sites, as well as from other activities, principally related to dispersed recreation, that lead to ground disturbance. Effects may also include increased or decreased vegetation on protected sites due to increased light with canopy layer reduction outside of the protected buffer.

## **Direct and Indirect Effects**

### **Alternative 1**

In general, archeological surface and subsurface site integrity is subject to adverse effects that may result from the buildup of hazardous fuels and lack of forest management. These increase the potential for wildfire occurrence, intensity, and tree mortality. Fires occurring in areas with dense concentrations of combustible material have the potential to burn with greater than normal intensity and duration, potentially altering the physical integrity and/or research value of the archeological record. Resulting soil exposure can lead to increased erosion, potentially disturbing or resulting in a loss of archeological soil matrices and/or site components. With no action (alternative 1), historic properties would continue to degrade.

### **Alternative 2**

Selected access changes, soil restoration work, and opening of forested areas resulting from timber harvest could impact cultural resources. Improved access and visibility to the forest landscape increases the potential for damage from natural and human action (i.e. erosion, impacts of unauthorized or inappropriate OHV usage, and looting).

Project components with potential to directly affect archeological sites primarily include timber, prescribed fire, road management, and some wildlife management activities. However, if the prescribed mitigation measures discussed in Chapter 2 are properly implemented, project activities will not be expected to adversely affect cultural resources.

### **Cumulative Effects**

Although the alternative 1 would eliminate risk of inadvertent effects to cultural resources from planned activities, it would result in a marked increase in potential damage from unmanaged and unmonitored resources. Intrusive vegetation would not be controlled. Fuel load would accumulate, and the risk of uncontrolled fires, potentially damaging to cultural resources, would increase. The lack of federal presence in the area could be expected to increase the potential for damage to cultural resources from looting, vandalism, and other illegal or unmanaged use of the Forests.

The greatest risks for archeological sites on the Forest come from unmanaged and unmonitored resources. Planned management and restoration activities benefit the cultural landscape by controlling intrusive vegetation, excessive accumulation of fuel load and risk of wildfire, and managing recreational use (i.e. dispersed campsites, OHV usage of roads and trails). The federal presence that results from the implementation of project activities would be expected to benefit cultural resources over time by increasing opportunities for the monitoring of sites for looting and vandalism, thus assisting with enforcement of federal protection laws.

### **Protection Measures for Historic Properties – Alternative 2**

The following measures only apply to cultural resource sites that are unevaluated, eligible for listing, or listed in the National Register of Historic Places.

*HPI: Site Avoidance during Project Implementation*

Avoidance of historic properties will require the protection from effects resulting from the undertaking. Mitigation measures include establishing clearly defined site boundaries and buffers around archeological sites where activities that might result in an adverse effect and routing new roads, temporary roads, log landings, and skid trails away from historic properties. Buffers will be of sufficient size to ensure that site integrity is not compromised.

*HP2: Site Protection During Prescribed Burns*

- (1) *Firelines.* Historic properties located along existing non-maintained woods roads used as firelines will be protected by hand-clearing those sections that cross the sites. Although these roads are generally cleared of combustible debris using a small dozer, those sections crossing archeological sites will be cleared using leaf blowers and/or leaf rakes. There will be neither removal of soil, nor disturbance below the ground surface, during fireline preparation. Historic properties and features located along selected routes of mechanically-constructed firelines, where firelines do not currently exist, will be avoided by routing fireline construction around historic properties. Sites that lie along previously constructed dozer lines from past burns (where the firelines will be used again as firelines) will be protected during future burns by hand clearing sections of line that cross the site, rather than re-clearing using heavy equipment. Where these activities take place outside stands not already surveyed, cultural resource surveys and consultation will be completed prior to project implementation. Protection measures HP1, HP3, and HP4 will be applied prior to project implementation to protect historic properties.
- (2) *Burn Unit Interior.* Combustible elements at historic properties in burn unit interiors will be protected from damage during burns by removing excessive fuels from the feature vicinity and, where applicable, by burning out around the feature prior to igniting the main burn and creating a fuel-free zone. Historic properties containing above ground, non-combustible cultural features and exposed artifacts will be protected by removing fuel concentrations dense enough to significantly alter the characteristics of those cultural resources. For sites that have been previously burned or do not contain combustible elements or other above-ground features and exposed artifacts, no additional measures are proposed. Past research indicates that prescribed burning will not be sufficiently intense to cause adverse effects to these features.
- (3) *Post-Burn Monitoring.* Post-burn monitoring may be conducted at selected sites to assess actual and indirect effects of the burns on the sites against the expected effects. SHPO consultation will be carried out with respect to necessary mitigation for any sites that suffer unexpected damage during the burn or from indirect effects following the burn.

*HP3: Other Protection Measures*

If it is not feasible or desirable to avoid a historic property that may be harmed by a project activity (HP1), then the following steps will be taken:

- (1) In consultation with the Arkansas SHPO, the site(s) will be evaluated against NRHP significance criteria (36 CFR 60.4) to determine eligibility for the NRHP. The evaluation may require subsurface site testing;

- (2) In consultation with the Arkansas SHPO, relevant federally-recognized Tribes (and if required with the ACHP), mitigation measures will be developed to minimize the adverse effects on the site, so that a finding of No Adverse Effect results; and
- (3) The agreed-upon mitigation measures will be implemented prior to initiation of activities having the potential to affect the site.

*HP4: Discovery of Cultural Resources during Project Implementation*

Although cultural resources surveys were designed to locate all NRHP eligible archeological sites and components, these may go undetected for a variety of reasons. Should unrecorded cultural resources be discovered, activities that may be affecting that resource will halt immediately. The resource will be evaluated by an archaeologist, and consultation will be initiated with the SHPO, tribes and nations, and the ACHP to determine appropriate actions for protecting the resource and mitigating adverse effects. Project activities at that locale will not resume until the resource is adequately protected and until agreed-upon mitigation measures are implemented with SHPO approval.

## **8. Vegetation Resources and Vegetation Diversity**

### **Existing Condition**

The Brushy Mountain project area is situated within the Boston Mountain eco-region located in the central part of the Ozark National Forest. Historically, the lands that are now the Ozark National Forest consisted of fire-dependent woodland and forest ecosystems with well-developed herbaceous understories. There was a more frequent regime of vegetation disturbance from anthropogenic fire than what has been common since the early 1900's. Early travelers in the Ozarks reported that Native Americans burned the woods on a regular basis. Frequent fire in forest/woodland ecosystems would invariably have produced open, less dense stands with a higher proportion of vegetation adapted to fire. Mean fire-return interval from 1680-1820 ranged from 4.6 to 16 years, from 1821-1880 mean fire-return interval ranged from 2 to 3.1 years and for the period of 1881-1920 it ranged from 1.4 to 5 years. From 1921-2000 mean fire-return interval for these areas ranged from 62-80 years (Guyette and Spetich 2003). This last period is widely recognized as the fire-prevention awareness era. State and federal agencies began to actively participate in organized wildfire suppression and began concentrating on educating the public in fire prevention consciousness.

Native-American fires and natural fires more than likely occurred periodically, long before European settlement and, along with other factors, greatly influenced the development and structure of the pine and hardwood forests that existed when the first settlers arrived in the Ozarks. Historian Steven Pyne (2001):

The modification of the American continent by fire... was the result of repeated, controlled surface burns on a cycle of one to three years, broken by occasional holocausts from escaped fires and periodic conflagrations during times of drought. Even under ideal circumstances, accidents occurred: signal fires escaped and campfires spread... So extensive were the cumulative effects of these modifications that it may be said that the general consequence of the Indian occupation of the New World was to replace forested lands with grassland or

savannah, or, where the forest persisted, to open it up and free it from underbrush. Most of the impenetrable woods encountered by explorers were in bogs or swamps from which fire was excluded; naturally drained landscape was nearly everywhere burned. Conversely, almost wherever the Europeans went, forests followed. The Great American Forest may be more a product of settlement than a victim of it.

Review of historical fire records from 1930 to 1958 from the Pleasant Hill Ranger District (located in District Files) indicates that lightning had been a source of ignition and averaged around 4 fire occurrences per year. In 1936, lightning started 20 fires during the very dry summer and early fall months (rainfall less than half normal) across the District. Up until the last 15 years, wildfires have largely been excluded from the project area due to an aggressive fire suppression program. This has allowed stem density to increase significantly in areas previously maintained in more open stand conditions by recurring fire.

Fire prevention awareness, creation of barriers to wildlife such as roads, and a long-standing policy of fire suppression have led to higher forest health risks and problems due to abnormally dense forest conditions and unsustainable ecosystems. Existing ecological conditions in the project area include a dense, overstocked forest, a shift from the historic plant community composition toward fire-tolerant plant species, and a lack of herbaceous species diversity and insect epidemics.

Most of the Ozarks, prior to National Forest acquisition, was extensively harvested for lumber and pulpwood during the early 1900's. Much of the hardwood forestlands were heavily logged for railroad ties and barrels in the early part of the 20th century. Small acreage farms were settled along floodplains and flat ridges in the late 1800's and early 1900's, many of which were abandoned and later acquired or purchased by the Forest Service. Much of these acquired lands were then planted with shortleaf pine. Chestnut blight removed Ozark chinquapin, a common midstory/overstory species, during the 1920's and 30's. Settlers periodically burned the areas to control insect pests and improve grazing. Prior to this, the vegetative changes occurred because of natural effects (herbivore grazing, wind, disease, and wildfire) and Native American fires. Heavy cutting from the late 1800's to the 1930's combined with land clearing and periodic burning by settlers, the occasional lightning, Native-American fires described above, and cattle/hog use greatly influenced the ecological conditions that favored the development of the forests that now exist in the project area.

Timber harvesting, land clearing, and other uses (especially hog and cattle grazing) from pioneer days to present have developed a somewhat diverse and fragmented ecosystem across the Brushy Mountain project vicinity. Farming continues on some private lands with the maintenance of pasture and some crop acreage on the mountaintops and along the Mulberry River and Highway 23. Streams and drains within the project area have riparian ecosystems of varying widths which provide additional vegetative diversity. Privately-owned land comprises significant blocks around the project area. This area varies from improved pastures to heavy woods.

The compartments for which vegetation was analyzed contain approximately 12,707 acres of National Forest land, of which 10,730 acres are suitable timber-producing lands. The project area consists of pine timber types (31%) and hardwood timber types (69%). Currently, the

project area reflects age-classes that may be considered skewed toward older forest stages, with 65% of stands being over 80 years old (Table 23). National Forest lands in the project area consist of the following age-class distributions:

**Table 23. Current Age-Class distribution in Brushy Mountain project area on Public Land.**

All - Age-classes by Timber Type								
Ages-Classes	0-10	11-20	21-40	41-60	61-80	81-100	101+	Total Acres (USFS)
Pine Acres	0	39	904	2271	263	405	0	3882
Hdwd Acres	0	0	305	232	723	6455	1110	8825
<b>Total Acres</b>	<b>0</b>	<b>39</b>	<b>1209</b>	<b>2503</b>	<b>986</b>	<b>6860</b>	<b>1110</b>	<b>12,707</b>
% of total acres (USFS)	0	1	3	21	9	55	10	100

Total acreages may vary slightly from those mentioned previously based on rounding computations. Mixtures of pine and hardwood stands have been simply aggregated into the larger categories of either pine or hardwood depending on its majority species.

### Timber

Current conditions and characteristics of stands selected for timber harvesting and other silvicultural activities are listed in Appendix A.

The Brushy Mountain project area has approximately 1,745 acres (<14%) that are currently classified as unsuitable for timber production. Of these, approximately 1,618 acres (13%) can be considered as old-growth forest management status.

### Direct and Indirect Effects

#### Alternative 1

In the next ten years with no timber harvesting, wildlife habitat work or prescribed burning, this alternative would allow another 624 acres (5% - acres of 61-80 yrs old) to move into the >80 year old age-class, comprising a total of 70% of the project area. The health of dense, older timber stands needing treatment would continue to decline and they would become more susceptible to insects and disease. Potential productivity and/or wood volume would decrease as a result of increased competition and mortality. This alternative would not meet the desired future condition as preferred in the Forest Plan and would forego the opportunity to regenerate oak and pine forestlands. This alternative does not address the stated purpose and needs of this project.

There would be a cumulative effect of late-successional, shade-tolerant species (such as maple and beech) replacing the early-successional, more shade-intolerant species (such as oaks) at all canopy levels and in the understory. Old fields that have been planted with pine and naturally-occurring pine areas would eventually be replaced by hardwood that currently exists in the understory/midstory of these stands. Most of the timber and wildlife outputs identified in the RLRMP would not be gained in the Brushy Mountain project area.

#### Alternative 2

The estimated pine volume produced will be 31,428 CCF of sawtimber and 7,857 CCF of small roundwood. Hardwood volume is predicted to be 1,912 CCF of sawtimber and 478 CCF of small roundwood for a total of 41,675 CCF (CCF = one hundred cubic feet).

Pine thinning will occur on approximately 2,580 acres and hardwood thinning on 282 acres. Its effects will increase vigor & growth of residual trees, reduce the susceptibility of the stand to insect and disease, and improve habitat for wildlife. Densities will be reduced for more penetrating views: more herbaceous and brushy vegetation will ensue for more wildlife species benefits, especially after midstory control measures of TSI (handtool/herbicide) and burning occur.

The pine stands will be thinned to a target basal area of 60-80ft<sup>2</sup>/acre. Trees that are suppressed or that have poor form will be targeted for removal. Trees of good form and/or close to the correct spacing will be favored over trees that are simply of larger size. The target spacing will depend on the average diameter of the trees in the stand. Thinning allows more light to reach the forest floor, thereby increasing herbaceous vegetation.

The effects of Pine Seedtree harvests on approximately 45 acres (two forest stands) will be the eventual replacement of mature even-aged stands with immature even-aged stands containing planted and naturally-seeded pine (and some hardwood) sprouts. This harvest method meets the guidelines and objectives set out in the RLRMP. It is appropriate because the native shortleaf pine have reached mature age, exhibit good cone-bearing characteristics, and are located on soils suitable for natural pine regeneration.

Treating some of the remaining non-merchantable hardwoods with herbicides in these areas that are not needed for wildlife and other purposes, will let light reach the forest floor and allow pine seeds to germinate in these areas. Prescribed burning for site preparation in these and other areas before a good pine seedfall will reduce the duff and litter, topkill small hardwood brush, and expose some bare soil, which will promote a successful seed catch from the overstory pine trees (good seedbed for natural seeding). These actions should ensure that areas of the present species composition can develop in the future. In the short term, the stands will be more open and early-stage vegetation would develop across these areas.

The effects of Hardwood Shelterwood harvests in two stands (approximately 52 acres) will be the replacement of mature even-aged stands with immature even-aged stands containing stump sprouts, naturally-seeded saplings and seedlings. A partial component of the original mature stands will be retained for genetic stock and give shelter to the young, natural regeneration. This harvest method meets the guidelines and objectives set forth in the RLRMP. It is appropriate because the hardwood trees have reached mature age, exhibit good seed/acorn-bearing characteristics, and are located on soils suitable for natural regeneration. Artificial regeneration (planting of oak) will occur to ensure stocking levels are met.

Treating some of the remaining non-merchantable hardwood/pine with herbicides in the shelterwood areas that are not needed for wildlife and other purposes will allow let light reach the forest floor, and allow stump/root-sprouting and acorns to germinate in these areas. In the short-term, the stands will be more open and early-stage vegetation will develop across the area. Within 10-15 years, the understory will be very dense and begin emerging into midstory status.

Approximately 318 acres of WSI will be implemented in the project area. The effects of this treatment will be to restore open woodland conditions to low-quality timber areas. Selective herbicide application, chainsaw felling and/or mechanical means will be used to reduce basal area to approximately 50 sq feet/acre. This will allow for greater light penetration to the forest floor and provide increases in herbaceous species diversity and abundance. Game species such as white-tailed deer and turkey will benefit from this activity. Disturbance-dependent neo-tropical migratory birds will also benefit. TES bat species will benefit from habitat improvement as well as rare plants such as small-headed pipewort.

The effects of Glade Restoration on approximately 4 acres will remove encroaching hardwood, cedar, and pine trees from a glade which contains small-headed pipewort; this is a Forest Service Region 8 sensitive plant species (rare plant). This work will be accomplished by selective herbicide application chainsaw felling, and/or mechanical means.

**Wildlife Habitat Improvement Prescribed Fire** – Approximately 4,162 acres will benefit TES plant and animal species, improve woodland conditions and plant diversity, improve habitat for game species (white-tailed deer and turkey) and neo-tropical migratory birds and resident birds which are disturbance-dependent. All WSI and glade restoration areas are located within the burn units. Burn units primarily utilize natural barriers and roads for control lines and will require minimal fire-line construction, mowing, disking, seeding, fertilizing and liming.

The effects of other prescribed burning on federal land and private land (with landowner's consent) will be the replacement of brushy and woody vegetation in the understory to a more grass and forb composition, benefiting quail, deer, and neo-tropical migratory birds. Oak and pine regeneration will be encouraged, fuel accumulations will be reduced, risk of wildfire will decrease, and an increase in favorable habitat for historic fire-tolerant vegetation species will occur.

The effects of eliminating NNIS and the wood shrub layer underneath sparse forest canopies will be to restore natural, historically endemic vegetation, as well as faunal and avian species that once thrived in pre-settlement times. Both activities will require handtool, herbicide, mechanical, and burning methods to be accomplished

The effects of creating 10 new wildlife openings (19 acres) and expanding 22 existing openings (41 acres) by dozer/herbicide/burning will be the replacement of a moderately-dense overstory with a variety of grasses and forbs that will be suitable for forage by ground-dwelling animals.

### **Cumulative Effects**

The cumulative effects from implementing alternative 2 on vegetative diversity of the project area, relative to the no-action alternative, are shown in Table 24:



**Table 24. Effect of vegetative diversity changes under Alternative 2 timber harvesting actions (acres).**

Forest Type	Within-Stand Diversity (Thinnings)	Between-Stand Diversity (Even-Aged Management)
Hardwood	0	0
Pine	1,757	0

Implementation of this alternative is not expected to have a negative cumulative impact on vegetation. The forest condition will be improved and left in a more sustainable condition. Risk of insect/disease outbreaks will decrease and the vigor of residual trees will increase. Also, potential old-growth will not decrease in the project area.

Regenerating mature pine and hardwood stands will have a positive impact on the vegetative diversity of the project area. There exists a need to provide more acres to the younger age class by converting some of this older age class to young stands, a future scenario of widespread mortality due to advanced age of the forest will be reduced. In addition, a variety of wildlife species that thrive in early-successional habitat will begin to increase with the implementation of alternative 2. Glade restoration actions and opening construction will further deliver younger vegetation for wildlife to prosper. Reducing stand densities, though commercial thinning, to levels below maximum SDI (Stand Density Index) will improve overall forest health by reducing competition for available essential water and nutrient resources, provide free growing space, and increase the overall growth potential of the residual stands.

Alternative 2 will allow forest health management to take place because it results in stands that are stocked to their optimum level. The forest stands in need of vegetation management, particularly those mature stands that are beginning to decline will be regenerated and vegetative diversity will increase and the desired future condition of the forest will be met.

Beyond the scope of this project, future vegetation management is not expected to take place for 15-20 years. By this time, many of the stands that receive commercial thinning treatments should be ready for regeneration. Regeneration harvest will further reduce the amount of the project landscape that is in the 80 to 100+ year age classes. No future management is anticipated to have a negative impact on the forest landscape.

## **9. Wildlife Resources**

### **Existing Condition**

Wildlife, fish and plant species and their habitats in the project area are managed in cooperation with the Arkansas Game and Fish Commission (AG&F), and the Arkansas Natural Heritage Commission (ARNHC). The state wildlife management agencies main responsibilities are to set policy for hunting and fishing regulations and law enforcement programs. The ARNHC is responsible for collecting and maintaining information on rare plants, animals and natural communities in Arkansas. The Forest Service is responsible for managing fish and wildlife habitat conditions on National Forest lands. The following discussion focuses on the habitat conditions that support wildlife populations and fisheries.

The aquatic fauna in the project area is very diverse. The richness and diversity of this area is the result of several factors including long geological history of favorable climates and habitats, a lack of glaciation during the Pleistocene era, and a wide variety of aquatic habitats in the Boston Mountain eco-region. The streams within the eco-region are typically clear, extremely high gradient, and riffle and pool habitat dominated systems with gravel, cobble, boulder, and bedrock dominated substrates of sandstone, shale, and limestone. The Boston Mountain eco-region does not have as many karst features as some of the other eco-regions in this part of Arkansas, but there are still many caves, springs, and seeps within the system. Streams within the Boston Mountain eco-region are classified as nutrient-poor systems with much of the energy derived from an allochthonous (carbon sources & other nutrients that come from outside the native aquatic system) food chain.

The diversity of wildlife species within this project area is typical of the Boston Mountains of the Ozark Plateau (USDA 1990).

Wildlife habitat has been altered by the oak decline phenomenon, particularly the red oak borer infestation. Progression of oak decline on the District is resulting in habitat changes which could include a long-term reduction in hard-mast production, an increase in the amount of soft-mast production as non-oaks make up more of the overstory, and a short-term higher density of snags and down trees.

The Pleasant Hill Ranger District reflects conditions that are seen forest-wide in relation to age classes of forest stands. The project analysis area contains a high proportion of late-seral wildlife habitat, and lacks open woodland capable of supporting diverse understory grass and herbaceous vegetation.

Under the National Forest Management Act (NFMA) regulations adopted in 1982, selection of management indicator species (MIS) during development of forest plans is required (36 CFR 219.19 [a]). The MIS are selected “because their population changes are believed to indicate the effects of management activities” (36 CFR 219.19 [a] [1]). They are used during planning to help compare effects of alternatives (36 CFR 219.19 [a] [2]) and as a focus for monitoring.

**Table 25. MIS Species, Habitat Requirements and Population Trends (summary)**

Species	MIS Type	Habitat Requirements	Population Trend
Northern bobwhite	ecological indicator	pine and oak woodland and native grasslands (early successional habitat)	Decreasing
Whitetail deer	Demand	mosaic of forest age classes	stable to increasing*
Black bear	Demand	remote habitat with mature forest component with intermixed regeneration	stable to increasing*
Wild turkey	Demand	mature forest with open areas containing grasses/forbs/soft mast	stable to decreasing* (increased poults 2012)

**Table 25. MIS Species, Habitat Requirements and Population Trends (summary)  
(cont'd)**

Prairie warbler	ecological indicator	regenerating forest communities, old fields, oak woodland (early successional habitat)	decreasing
Brown-headed nuthatch	ecological indicator	pine woodland habitat	R8Bird Ozark NF (increasing) BBS (decreasing)
Cerulean warbler	ecological indicator	mature and over-mature forest habitat	R8Bird Ozark NF (stable-increasing) BBS (decreasing)
Northern parula	ecological indicator	riparian forest habitat	R8Bird Ozark NF (increasing) BBS (decreasing)
Ovenbird	ecological indicator	dry oak & dry-mesic oak forest habitat	Decreasing
Red-headed woodpecker	ecological indicator	dry oak & dry-mesic oak forest habitat	R8Bird Ozark NF (increasing) BBS (decreasing)
Pileated woodpecker	ecological indicator	large snags & older forest habitat	decreasing
Scarlet tanager	ecological indicator	dry oak & dry-mesic oak forest habitat	R8Bird Ozark NF (increasing) BBS (decreasing)
Acadian flycatcher	ecological indicator	mid-aged to mature hardwood forest habitat	Increasing
Smallmouth bass	Demand	cool water stream communities	Stable
Largemouth bass	Demand	quality pond and lake habitat	Stable

\* information from AGFC harvest and monitoring data

Sixteen species were selected as MIS for the Ozark National Forests. These 16 species resulted from the Planning Team's review of the list of vertebrate species dependent upon forest habitats.

A MIS Report on population data including population trends was completed on July 6, 2001, (amended August 15, 2001) for the OSFNFs. This document is part of the analysis file and was used for analysis of effects to MIS species associated with implementation of project alternative. The 2001 MIS report contains some but not all of the current MIS as selected for the RLRMP. Data from this report (USDA, 2001) was compared to AGFC harvest and survey information for game species, breeding bird survey data, and population trend data from the NatureServe database for MIS species (AGFC 2001, 2006, 2007, 2009, 2011, 2012, USDA 2001, USDA 2007, and NatureServe 2013).

Table 25 shows Ozark National Forest MIS species pertinent to the Pleasant Hill Ranger District, the habitat type they represent and population trends (AGFC 2001, 2006, 2007, 2009, 2011, 2012, USDA 2001, USDA 2007 and NatureServe 2013). From the Forest MIS list, 15 species have potential habitat on the Pleasant Hill Ranger District. Many of these species have documented occurrences on the District, others which have not been documented, have potential habitat existing on the District. All 15 MIS species shown in Table 25 will be addressed further in this document.

In 1996, the Southern Region of the USDA Forest Service adopted “The Southern National Forest’s Migrant and Resident Landbird Conservation Strategy” (Gaines and Morris, 1996) to improve monitoring, research, and management programs affecting forest birds and their habitats. A region-wide program of monitoring avian populations based on point-counts was initiated as part of this strategy. The results of this monitoring effort are reported in General Technical Report – NRS-9, and summarized in Table 25 (Taylor, 2013) for MIS avian species on the Ozark National Forest (USDA, 2007). Data collected from 1992 to 2004 is utilized. Sampling strategy and point-count methodology is described in detail in Gaines and Morris (1996).

The project area is a mature forest matrix generally composed of an oak-hickory sub-matrix and a shortleaf pine sub-matrix. Grassland areas in the analysis area comprise less than 1% of the project area. Currently, there are 22 managed wildlife openings in the project area, comprising approximately 41 acres. Additional grass/forb habitat on federal lands is also found in prescribed burn areas, glades, private land pastures, utility rights-of-way, and roadsides.

Hard mast capability is well distributed across the landscape. The majority of the project area’s hardwood forest types are currently of mast-producing age. These age classes are those which are 40+ years of age. These stands are found within stream corridors and on all aspects with the best representation found on the north and east slopes. Mast-producing trees are also represented within the shortleaf pine sub-matrix, but to a lesser degree.

The mast needs of many forest animals are met when at least 20% of 640 acres (one square mile) is occupied by well-distributed mast-producing hardwood trees (Wildlife Habitat Management Handbook, 204.1).

The majority of pine forest types and hardwood forest types in the project area are currently in age classes >61 years of age.

**Table 26. Forest Age Class Distribution by Alternative (public lands)**

<b>Age Classes (years)</b>	<b>Alternative 1 (acres/% total)</b>	<b>Alternative 2 (acres/% total)</b>
grass/forb*	41 acres / 0.3%	60 acres / 0.5%
0-10	0 acres / 0%	97 acres / 1%
11-20	39 acres / 1%	39 acres / 1%
21-40	1209 acres / 3%	1209 acres / 3%

**Table 26. Forest Age Class Distribution by Alternative (public lands) (cont'd)**

41-60	2503 acres / 21%	2484 / 20%
61-80	986 acres / 9%	986 acres / 9%
81-100	6860 acres / 55%	6763 acres / 53%
101+	1110 acres / 10%	1110 / 10%

\*some grass/forb habitat is found on existing road and utility right of ways,

With implementation of alternative 2 approximately 60 acres of public land will be converted to or maintained as grass/forb habitat through existing wildlife opening maintenance, existing wildlife opening enlargement and new wildlife opening construction.

Implementation of conversion to grass/forb habitat will result in 0.5% of the public land-base within the project area compartments in this habitat type, as opposed to 0.3% under current conditions. Through construction/enlargement of wildlife openings approximately 19 acres will be changed from the current 41-60 year age class – to grass/forb habitat.

Approximately 318 acres of wildlife stand improvement thinning and 4 acres of glade restoration will be completed with implementation of the proposed action. Thinning will reduce canopy density and tree basal area, thereby providing better habitat conditions for native herbaceous species.

Approximately 2,869 acres will be restored to woodland condition through thinning in the 41-80 year age classes and maintenance prescribed burning. Browse and early-successional habitat will be provided in these thinned areas for a variety of wildlife species, especially when combined with prescribed fire. Viability of disturbance-dependent avian species will be enhanced. Avian species requiring both large and small areas of early successional vegetation and forest edge will benefit.

Implementation of alternative 2 will result in less than a 2% reduction of forest habitat that is greater than 81 years old (federal lands). Following implementation, approximately 63% of the forested (both pine and hardwood) public land base within the project area compartments will remain in the 81-101+ year age classes. With implementation of alternative 2, and taking into consideration recruitment of stands from the 61-80 year age class over the next 1-10 years (approximately 986 acres or 9% of project area land base), as well as examination of distribution of stand age classes, fragmentation of interior forest habitat is not anticipated.

### **Direct and Indirect Effects**

#### **Alternative 1**

Currently approved management actions would be maintained under alternative 1.

Effects to wildlife and MIS from implementation of the no action alternative are analyzed in detail in a reference paper compiled by the Pleasant Hill Ranger District (Taylor, 2013). This paper is part of the project analysis file. Findings of this paper are summarized here.

**Timber Harvest and Wildlife Habitat Improvement:** Effects of implementation of the no action alternative are described in Taylor (2013), in relation to the subsections Early Successional Habitat, Soft Mast Production, and Hard Mast Production. Indirect beneficial effects to wildlife species dependent upon older seral stages, and habitat requirements associated with closed-canopy conditions would occur. Thinning to help restore woodland conditions and to improve herbaceous diversity would not occur. Short-term early successional habitat in regenerated forest stands would not occur, thereby causing negative indirect effects to disturbance-dependent and early successional obligate wildlife species. Lack of thinning and regeneration harvest would not allow for improved production of soft mast. Increases in abundance of soft mast, utilized by a variety of wildlife species as a reliable seasonal food source would not occur. Regeneration silvicultural treatments would not be implemented to provide age class diversity and maintain oak in the ecosystem as a source of hard mast for wildlife species. Oak species would be expected to become a minor component of the forest ecosystem in the long-term without significant forest stand disturbance or treatments that favor oak regeneration. Pine woodland with abundant herbaceous understory would not be created or maintained. This alternative would cause negative indirect impacts to wildlife species. Forest Plan (USDA, 2005) recommendations of diverse, high quality habitats supporting well-distributed and viable populations of all native and desired non-native plants and animals would not be met. Natural disturbance regimes within terrestrial habitats providing a stable and sustained flow of both early- and late-successional habitats over time would not meet desired conditions for fish and wildlife habitat.

**Timber Stand Improvement Practices:** TSI practices; silvicultural release and pre-commercial thinning practices and planting of hardwoods in oak-poor areas would not occur. Lack of improvement of stands containing beneficial tree species for wildlife would not occur, thereby, causing indirect adverse impacts.

**Prescribed Fire:** Prescribed fire would not be implemented in the project analysis area with adoption of this alternative. Benefits to wildlife from: sustaining oak in the ecosystem for hard mast production; restoring woodlands for increased herbaceous diversity and density; maintaining pine as a significant component in the ecosystem; and maintaining other fire-dependent or adapted species and habitats would not occur. Lack of prescribed fire would not allow for improved production of soft mast. Increases in abundance of soft mast utilized by a variety of wildlife species as a reliable seasonal food source would not occur. This would cause negative indirect impacts to wildlife species. Forest Plan (USDA, 2005) recommendations of diverse, high quality habitats supporting well-distributed and viable populations of all native and desired non-native plants and animals would not be met. Natural disturbance regimes within terrestrial habitats providing a stable and sustained flow of both early- and late-successional habitats over time would not meet desired conditions for fish and wildlife habitat.

**Herbicide Use:** Without use of this tool, benefits to wildlife from pine woodland, wildlife openings and grass/forb habitat would be reduced. Herbicide use (foliar, hack and squirt, or cut stump treatment) provides longer lasting beneficial impacts to creating and maintaining early-successional habitat than can be expected with use of only mechanical means and prescribed fire. Benefits to species requiring early-successional habitat through use of herbicide would not occur. Without use of this tool, quality of woodland and grass/forb habitat for wildlife would be reduced.

**Road Work:** Road maintenance, road decommissioning and closure of roads to administrative use only would not occur. Alternative 1 would not serve to disconnect the road system from the stream network. Road maintenance at levels expected to occur with the action alternative would not occur, thereby allowing entrainment of sedimentation to continue in creeks from poor quality roads. This would cause adverse indirect impacts to water quality and aquatic species. Open road density in the project area would remain status quo, thereby allowing potential erosion to cause adverse indirect impacts to water quality and aquatic species. Gating to eliminate vehicle access and protection of an important resource value in the project area would not occur.

**Aquatic Species/Habitat Improvement:** Aquatic habitat for fish would not be improved through placement of LWD in stream channels. In most cases, LWD in streams would not meet desired conditions for fish and wildlife as specified in the Forest Plan (USDA, 2005). This would cause indirect adverse effects to aquatic species which may be currently limited through lack of habitat.

There would be no change short-term in the amount of closed-canopy forest habitat from current levels under the no action alternative. Species requiring interior/closed canopy forest habitat would be expected to remain stable or increase within the project analysis area. Species requiring forest openings, edges between different successional stages, and herbaceous/shrub browse would be expected to remain stable or decrease long-term within the project analysis area.

Habitat components within the project area would continue to be less than specified in the Forest Plan. Objectives as described in the Forest Plan (USDA, 2005) for bobwhite quail, whitetail deer, eastern wild turkey, black bear and largemouth/smallmouth bass (OBJ.10, OBJ.11, OBJ. 12, OBJ. 13, and OBJ. 15 respectively) would not be met with implementation of the no action alternative. Additionally, the objective for insect and disease management through thinning and regeneration of oak and pine (OBJ. 8) would fail to be met.

## **Alternative 2**

Effects to wildlife and MIS from implementation of alternative 2 are analyzed in detail in a reference paper compiled by the Pleasant Hill Ranger District (Taylor, 2013). This paper is part of the project analysis file. Findings of this paper are summarized here.

**Timber Harvest and Wildlife Habitat Improvement:** Effects of implementing alternative 2 are described in (Taylor, 2013) relation to the subsections Early Successional Habitat, Soft Mast Production, and Hard Mast Production. Indirect negative effects to wildlife species dependent upon older seral stages and habitat requirements associated with closed canopy conditions will occur. Thinning to help restore woodland conditions and to improve herbaceous diversity will cause positive indirect impacts to wildlife. Use of thinning will improve production of soft mast. Increases in abundance of soft mast utilized by a variety of wildlife species as a reliable seasonal food source will occur. Oak species and shortleaf pine will be expected to be maintained as a component of the forest ecosystem in the long-term. This alternative will cause positive indirect impacts to wildlife species. Diverse and high quality habitats supporting well-distributed and viable populations of all native and desired non-native plants and animals will meet desired conditions for fish and wildlife as specified

in the Forest Plan (USDA, 2005). Disturbance regimes within terrestrial habitats providing a stable and sustained flow of both early and late-successional habitats over time will meet desired conditions for fish and wildlife habitat as specified in the Forest Plan (USDA, 2005).

**TSI Practices:** These practices, which include release, pre-commercial thinning and tree planting, are beneficial to wildlife in the long-term. These practices provide indirect beneficial effects to wildlife by ensuring long-term perpetuation of shortleaf pine in the ecosystem.

**Prescribed Fire:** Implementation of prescribed fire may cause some direct mortality to small mammals and herpetofauna in the short-term. However, Kirkland (et.al. 1997) found that fire effects upon small mammals in oak-dominated forests are transitory. Quantitative differences between burned and unburned habitats were found to disappear within 8 months following the burn. Rapid recovery of populations of small mammals in burned forests may be due to the rapid regrowth of ground cover from surviving rootstocks. Research found there were few discernible differences in small mammal and herpetofauna populations between burned and control areas, supporting the contention that prescribed fire in the project area had little overall impact on the terrestrial vertebrate fauna. In addition, immediate impacts of the burn on small mammals are slight as many species exhibit varying degrees of fossorial habits (Ford et al. 1999). In a study within the upper piedmont of South Carolina, Kilpatrick (et. al. 2004) found that prescribed burning and thinning for fuel reduction had minimal effects on herpetofauna in upland pine plantations. Prescribed burning has been found to change the composition of woody species seedlings. Due to reduction in the number of shade-tolerant species from prescribed burning, greater equitability among tolerant and intolerant species seedlings occurred. Mechanical removal of understory vegetation followed by prescribed fire provided both greater equitability among species and higher levels of photosynthetically active radiation reaching the forest floor (Dolan, 2004). Prescribed burning and sub-canopy removal are important tools in improving conditions for pine seedling establishment while reducing competition from shade-tolerant species.

Short-term, negative, direct effects to wildlife may occur through use of prescribed fire. However, long-term, positive direct effects will be realized through habitat improvement for a variety of wildlife species.

**Herbicide Use:** Herbicide use is an important tool often used in woodland restoration thinning to prevent sprouting of woody species and therefore allowing for greater understory herbaceous vegetation abundance and diversity. In addition, herbicide use for TSI is an important tool for reducing competition with selected hard and soft mast producing tree species. Furthermore, herbicide is a tool of great importance creating/maintaining grass and forb habitat for wildlife. Woodland restoration thinning, creation of wildlife openings and grass/forb habitat and TSI will produce greater vegetation diversity and associated positive effects to wildlife with use of herbicide.

**Road Work:** No negative long-term impacts to wildlife will occur with the implementation of road reconstruction, road maintenance or temporary roading. Closure of roads following use with gates/mounds will reduce disturbance to wildlife. Reconstruction and maintenance of roads will lead to improved water quality by reducing existing erosion through use of improved road design features. Application of BMPs and Forest-Wide Standards (FW-72 – FW-76, FW-78, FW-79, FW-81, FW-82, and FW-87 – FW-90) will be utilized for all road



related work (USDA, 2005). Unmaintained and unauthorized non-system roads are one of the most common sources of accelerated erosion on National Forest lands. The selected action would serve to assist in “disconnecting” the road system from the stream network. Road maintenance will help preclude entrainment of sedimentation in creeks from poor quality roads. This will cause positive indirect impacts to water quality and aquatic species. Open road density in the project area will in most cases be reduced by road decommissioning and closure of roads with gates – allowing administrative access only. This will serve to reduce potential erosion, providing positive indirect impacts to water quality and aquatic species. Gating areas, including some large blocks, will provide habitats for species sensitive to human disturbance and provide opportunity for more remote wildlife-related recreation opportunities.

**Aquatic Species Habitat Improvement:** Implementation of alternative 2 will benefit native fish populations providing additional quality habitat through introduction of LWD for cover. LWD placed in streams will meet desired conditions for fish and wildlife as specified in the Forest Plan (USDA, 2005). Introduction of LWD into streams will provide direct beneficial impacts to aquatic species.

### **Cumulative Effects**

In summary, alternative 2 is predicted to have negative short-term impacts on 9 of 15 management indicator species analyzed. Negative impacts will be primarily short-term disturbance of individual animals and potential loss of nests. Viability of populations as a whole will not be reduced (Taylor, 2013).

The use of management actions as described in this Environmental Assessment will be of long-term benefit to MIS that rely upon forest ecosystems, particularly oak/pine ecosystems, for habitat. In summary, alternative 2 is predicted to have positive long-term effects on 15 of 15 management indicator species analyzed. Although some individual negative long-term effects are predicted, populations of all MIS will be expected to remain viable in the Ozark Highlands and on the National Forest (Taylor, 2013).

## **10. Threatened, Endangered, Sensitive (TES) Species**

### **Existing Condition**

Forest Service Manual (FSM) Section 2672.41 requires a biological evaluation (BE) and/or biological assessment (BA) for all Forest Service planned, funded, executed, or permitted programs and activities. The objectives of this BE/BA are to: 1) ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native species or contribute to trends toward federal listing, 2) comply with the requirements of the Endangered Species Act (ESA) so that federal agencies do not jeopardize or adversely modify critical habitat (as defined in ESA) of federally listed species, and 3) provide a process and standard to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision-making process.

Federally listed threatened and endangered species, species proposed for federal listing, and Southern Region sensitive species that may potentially be affected by this project were examined using the following existing available information:

- Reviewing the list of TES plant and animal species known or likely to occur on the OSFNFs, and their habitat preferences. This review included the U.S. Fish and Wildlife Service’s current list of endangered, threatened, and proposed species for Arkansas as of July 29, 2014, (USDI 2014), recent changes to the status of the Northern long-eared bat (USDI, 2015), the forest-wide list as of February 7, 2013 and the current Southern Region Sensitive Species list for the Forest, dated August 8, 2007 (list attached as Appendix A in BE).
- Consulting element occurrence records (EOR’s) for TES species as maintained by the Arkansas Natural Heritage Program (ARNHP).
- Consulting with individuals in the private and public sector who are knowledgeable about the area and its flora and/or fauna.
- Reviewing sources listed in the reference portion of this report.
- Reviewing the results of field surveys that have been conducted in the area.

Most TES species known to occur on the Forest have unique habitat requirements, such as glades, barrens, rock outcrops, bogs, caves, and natural ponds. Appendix A of the BE/BA lists all 67 TES species currently known or expected to occur on or near the OSFNFs. All species on the list were considered during the analysis for this project.

A “step down” process was followed to eliminate species from further analysis and focus on those species that may be affected by project activities. Species not eliminated are then analyzed in greater detail. Results of this “step down” analysis process are displayed in the Occurrence Analysis Results (OAR) column of the table in Appendix A. First, the range of a species was considered. Species’ ranges on the Forests are based on county records contained in such documents as An Atlas and Annotated List of the Vascular Plants of Arkansas, and NatureServe Explorer, but are refined further when additional information is available, such as more recent occurrences documented in scientific literature or in Natural Heritage databases. Many times, historic range information clearly indicates a species will not occur in the analysis area due to the restricted geographic distribution of most TES species. When the analysis area is outside a known species range, that species is eliminated from further consideration by being coded as OAR code “1” in the Appendix A table. For the remaining species, after this first step, results from past surveys, knowledge of the analysis area and potential for suitable habitat were considered.

These resources and information will be compiled to produce a site-specific BE for this project (Taylor, 2016). This BE will be sent to the U.S. Fish and Wildlife Service for review and concurrence prior to issuance of the decision notice for the proposal.

### **Species Identified as Being in the Action Area or Potentially Affected by the Action**

From past field surveys and knowledge of the area, and given the selected action, those species which are analyzed and discussed further in this document are those that:

- Are found to be located in the activity area (OAR code “5”),
- Were not seen during the survey(s), but possibly occur in the activity area based on habitat observed during the survey(s) or field survey was not conducted when species is recognizable (OAR code “6”), and
- Aquatic species or habitat known or suspected downstream of the project/activity area, but inside identified geographic bounds of water resource effects analysis area (OAR code “8”).

As a result of this process, Table 27 shows the following species occur as documented by field surveys or may potentially occur in the activity area based on habitat observations:

**Table 27. Results of Field Survey and Species that occur or could occur in the project area**

OAR Code	Scientific Name	Common Name	Taxa	Status
8	<i>Percina nasuta</i>	Longnose darter	fish	Sensitive
5	<i>Haliaeetus leucocephalus</i>	Bald eagle	Bird	Sensitive
5	<i>Corynorhinus townsendii ingens</i>	Ozark big-eared bat	Mammal	Endangered
6	<i>Myotis grisescens</i>	Gray bat	Mammal	Endangered
6	<i>Myotis leibii</i>	Eastern small-footed bat	Mammal	Sensitive
5	<i>Myotis septentrionalis</i>	Northern long-eared bat	Mammal	Threatened
6	<i>Myotis sodalis</i>	Indiana bat	Mammal	Endangered
8	<i>Cumberlandia monodonta</i>	Spectaclecase mussel	Mollusk	Endangered
6	<i>Lirceus bicuspicatus</i>	An isopod	Isopod	Sensitive
8	<i>Orconectes williamsi</i>	William’s crayfish	Crustacean	Sensitive
8	<i>Paduniella nearctica</i>	Nearctic paduniellan caddisfly	Insect	Sensitive
6	<i>Amorpha Ouachitensis</i>	Ouachita leadplant	Plant	Sensitive
6	<i>Callirhoe bushii</i>	Bush’s poppymallow	Plant	Sensitive
5	<i>Castanea pumila</i> var. <i>ozarkensis</i>	Ozark chinquapin	Plant	Sensitive
5	<i>Cypripedium kentuckiense</i>	Southern lady’s slipper	Plant	Sensitive
6	<i>Delphinium newtonianum</i>	Moore’s larkspur	Plant	Sensitive
6	<i>Dodecatheon frenchii</i>	French’s shooting star	Plant	Sensitive
5	<i>Eriocaulon koernickianum</i>	Small-headed pipewort	Plant	Sensitive
6	<i>Silene ovata</i>	Ovate-leaf catchfly	Plant	Sensitive
6	<i>Tradescantia ozarkana</i>	Ozark Spiderwort	Plant	Sensitive
6	<i>Valerianella nuttallii</i>	Nuttall’s cornsalad	Plant	Sensitive
6	<i>Valerianella ozarkana</i>	Ozark cornsalad	Plant	Sensitive

Twelve species were not seen during field surveys, but possibly occur in the analysis area based on habitat observed or the field surveys were conducted when the species is not recognizable (OAR “6”); 3 mammal species (gray bat Eastern small-footed bat and Indiana bat), 1 isopod species (*Lirceus isopod*) and 8 plant species (Ouachita leadplant, Bush’s

poppymallow, Moore's larkspur, French's shooting star, Ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad, and Ozark cornsalad).

The occurrence analysis results table shows 1 bird species (bald eagle), 2 mammal species (Ozark big-eared bat and Northern long-eared bat), and 3 plant species (Ozark chinquapin, Southern lady's slipper and small-headed pipewort) were identified within the analysis area (OAR "5").

The occurrence analysis results table shows 1 fish species (longnose darter), 1 mollusk species (spectaclecase mussel), 1 crustacean species (William's crayfish) and 1 insect species (Nearctic paduniellan caddisfly) are known or suspected to occur downstream of the project area (OAR "8").

### **Direct and Indirect Effects of Selected Management Action on Each Identified Species**

The analysis of possible effects to species identified as known or expected to occur in the vicinity of the project area, or likely to be affected by the action, includes the following existing information:

- Data on species/habitat relationships.
- Species range distribution.
- Occurrences developed from past field surveys or field observations.
- The amount, condition, and distribution of suitable habitat.

Effects to species include anticipated effects from implementation of the selected action. Predicted effects to species shown in Table 27 are described in the BE for the Brushy Mountain project (Taylor, 2016).

A site specific water quality analysis was completed for the Brushy Mountain project area (Monk, 2016). These water quality analyses are based on modeling developed for use on the Forest (Klingenpeel & Crump, 2005) and were applied to all selected management actions associated with the Brushy Mountain project area. This modeling and sedimentation analysis was utilized for determination of effects to aquatic resources from implementation of the selected action.

Site specific modeling finds that the direct and indirect impacts from this project are not expected to contribute to degradation of the current water quality. Implementation of the activities associated with the alternative will result in some of the above mentioned effects to short-lived in this part of Arkansas. Under the selected alternative, the concern level remains low and sediment decreases from the current condition in two of the four project area watersheds due to elimination of 19 miles of unneeded roads. The cumulative effects analysis indicates minimal risks to the water resource's current condition. Forest Service activities will result in an overall decrease in sediment production.

Additionally, it should be possible to schedule these activities over time instead of instantaneously as predicted by the analysis, thus reducing the possibility of acute effects. Through the use of forest plan standards and the use of Arkansas Silviculture BMPs, the activities scheduled for implementation should not pose additional risks to water quality or designated uses (Monk, 2016).

## **Cumulative Effects**

Based upon the site-specific water quality analysis for the Brushy Mountain project - the minor sediment increase from alternative 2 is expected to be insignificant in comparison to the existing sediment load of the Mulberry River and its tributaries, and will not have significant effect on habitat for fish or other aquatic life. There will be no negative direct, indirect or cumulative effects to aquatic species from implementation of management activities associated with this project. No significant impacts (from loss of water quality) will result from implementation of this project that will push aquatic species closer toward federal listing under the ESA, or cause loss of viability for these species. There are no foreseeable activities in the area that will directly or indirectly affect water quality needs for longnose darter, spectaclecase mussel, *Lirceus bicuspicatus*, William's crayfish and Nearctic paduniellan caddisfly or cause additive or synergistic adverse cumulative impacts in conjunction with the selected action – due to sedimentation. Therefore, there will be no negative direct, indirect, or cumulative effects to these species as a whole from management activities associated with this project due to sedimentation.

Individuals of the species *Lirceus bicuspicatus* (lirceus isopod) may be directly impacted in upland areas away from the Mulberry River and its tributaries. Effects to individuals in these locations will be from direct physical disturbance. However, the selected action is not likely to cause a trend to federal listing under the ESA and won't cause a loss of viability for this species. There are no foreseeable activities in the area that will indirectly affect the *Lirceus* isopod in a negative manner or cause additive or synergistic adverse cumulative impacts to this species. Therefore, there will be no negative direct, indirect or cumulative effects to this species as a whole from management activities associated with this project.

### **Determination of Effects – “No Action” Alternative 1 (TES species)**

No negative adverse effects will occur to populations of federally listed (T&E) species (Ozark big-eared bat, gray bat, Northern long-eared bat and Indiana bat). Potential positive effects to bat species through habitat improvement will not occur.

No negative adverse effects will occur to Region 8 sensitive species (longnose darter, bald eagle, Eastern small-footed bat, *Lirceus bicuspicatus*, William's crayfish, Nearctic paduniellan caddisfly, Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, Moore's larkspur, French's shooting star, small-headed pipewort, ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad and Ozark cornsalad.

### **Determination of Effects –Alternative 2 (TES species)**

#### **Ozark big-eared bat**

The selected action was designed to totally incorporate all Forest-Wide Standards, and direction provided by the USFWS related to the conservation of all listed bat species.

There are no foreseeable, additional management activities in the area (not associated with this project) that will directly or indirectly affect the Ozark big-eared bat, or cause additive or synergistic adverse cumulative impacts in conjunction with the selected action.

With implementation of Forest-Wide Standards from the RLRMP which were developed in coordination with the USFWS during the revision process, the determination of effect for the Ozark big-eared bat related to this project is “may affect – not likely to adversely affect.”

### **Gray bat**

There are no foreseeable, additional management activities in the area (not associated with this project) that will directly or indirectly affect the gray bat, or cause additive or synergistic adverse cumulative impacts in conjunction with the selected action.

With implementation of Forest-Wide Standards from the RLRMP which were developed in coordination with the USFWS during the revision process, the determination of effect for the Gray bat related to this project is “may affect – not likely to adversely affect.”

### **Indiana bat**

There are no foreseeable, additional management activities in the area (not associated with this project) that will directly or indirectly affect the Indiana bat, or cause additive or synergistic adverse cumulative impacts in conjunction with the selected action.

With implementation of Forest-Wide Standards from the RLRMP which were developed in coordination with the USFWS during the revision process, the determination of effect for the Indiana bat related to this project is “may affect – not likely to adversely affect.”

### **Northern long-eared bat**

Research indicates that this species is resilient to or may benefit from forest vegetation management (Silvis et al, 2014 and Starbuck et al, 2015).

There are no foreseeable, additional management activities in the area (not associated with this project) that will directly or indirectly affect the northern long-eared bat, or cause additive or synergistic adverse cumulative impacts in conjunction with the selected action.

This project is likely to adversely affect the northern long-eared bat; however, there are no effects beyond those previously disclosed in the programmatic biological opinion on implementing the final 4(d) rule dated January 5, 2016, signed by Lynn Lewis. Any taking that may occur incidental to this project is not prohibited under this final 4(d) rule (50 CFR 17.40(o)). This project is consistent with the forest plan, the description of the selected action in the programmatic biological opinion, and activities that do not require special exemption from taking prohibitions applicable to the northern long-eared bat; therefore, the programmatic biological opinion satisfies the Forest Service’s responsibilities under ESA section 7(a)(2) relative to the northern long-eared bat for this project.

Implementation of this project may benefit Ozark big-eared bat, gray bat, Northern long-eared bat and Indiana bat by providing habitat improvement.

### **Sensitive Species**

For sensitive species residing in the Mulberry River or its tributaries, no significant impacts (from loss of water quality) will result from implementation of this project that would push aquatic species closer towards federal listing under the ESA, or cause loss of viability for

these species. There are no foreseeable activities in the area that will directly or indirectly affect water quality needs for these species.

For sensitive terrestrial species, bald eagle, Eastern small-footed bat, *Lirceus bicuspicatus* (upland populations), Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Southern lady's slipper, Moore's larkspur, French's shooting star, small-headed pipewort, ovate-leaf catchfly, Ozark spiderwort, Nuttall's corn salad, and Ozark cornsalad direct negative impacts to individuals of these species may occur through implementation of the project.. However, the project is not likely to cause a trend to the federal listing of these species under the ESA. Furthermore, there will be no loss of population viability for these species due to implementation of this project.

Implementation of the Brushy Mountain project will benefit sensitive species which require open (unshaded) and/or fire dependent habitats. These sensitive species include Ouachita leadplant, Bush's poppymallow, Ozark chinquapin, Moore's larkspur, small-headed pipewort, ovate-leaf catchfly, Ozark spiderwort, Nuttall's cornsalad and Ozark cornsalad.

Because there were no other sensitive species or habitat for such species present, the project will have no impact on any other Southern Region sensitive species (Taylor, 2016).

## **11. Human Health Factors**

### **Existing Condition**

At the present time, there is a risk of wildfire in the project area which potentially could affect human health factors. There are other human health risks for forest workers and visitors; primarily dead, dying or aging trees that create risk to human health from falling material. Falling trees and limbs on public lands can cause injury to National Forest visitors and can cause damage to personal property. Furthermore, portions of the project area have been affected by ice storm damage. Forest fuel accumulations and the interspersed of private lands/property within the analysis area, in combination, lead to the potential for negative effects to human health and property from wildfire.

The increasing amount of oak decline is another risk that could potentially affect human health in this area. With no action being taken, the oak decline will continue to progress, thus increasing the number of dead and dying oaks in the forest. This poses a serious threat to forest visitors sightseeing from a vehicle, hiking, biking, or hunting. Dead trees and/or heavy branches are more likely to fall at any moment which could cause injury or death to these types of dispersed recreation users.

### **Direct and Indirect Effects**

#### **Alternative 1**

There would be no change from the existing condition regarding risks to worker health from the use of herbicides, manual/mechanical vegetation treatments or prescribed fire. Risks to human health and safety from falling limbs and trees associated with oak decline and storm damage would increase due to rot, decay, and wind-throw. Currently, herbicide use is

authorized in the project area for use in reduction/eradication of NNIS and maintenance of established wildlife openings.

Potential accidents to workers completing manual/mechanical vegetation treatments and prescribed fire would be less with implementation of alternative 1.

Without the use of prescribed burning, the chances of a large wildfire will increase over time. In areas of moderate to heavy fuel accumulations it is more likely that a wildfire will result in severe fire intensity, thus eliciting more adverse effects than the slight to moderate intensity fire associated with intentional prescribed burning. Therefore, potential negative impacts to public human health will be greater with implementation of alternative 1.

## **Alternative 2**

There is a perception by the public that any use of herbicides on the Forests is unsafe. Herbicide is used in accordance with Forest-Wide Standards as described in the RLRMP and in accordance with herbicide label requirements. The routine adherence to these standards and requirements minimizes potential risk to human health and the environment. Syracuse Environmental Research Associates, Inc. (SERA) Risk Assessments for herbicides evaluate 2,4-D; imazapic; imazapyr; triclopyr; hexazinone; and glyphosate from a human safety viewpoint, evaluating risks, short-term effects and cumulative effects. All information contained in these Herbicide Risk Assessments (RA's) is incorporated by reference into this analysis (Refer to Herbicide Section). Risk assessments for these chemicals are documented in the project analysis file. Risk to the public from herbicide use is low and this is mitigated by use of Forest-Wide Standards and compliance with herbicide label requirements. The primary risk regarding herbicide use is related to herbicide applicators (either Forest Service employees or contractors). With proper handling/transport of herbicides, proper application equipment and methods and use of required protective personal equipment (PPE), risk of herbicide use to workers is mitigated.

## **Cumulative Effects**

Cumulative effects from using herbicides also pose no significant risk of causing unintended negative cumulative effects due to their short half-lives and the selectivity of the treatment methods.

According to SERA RA's, a hazard quotient (HQ) of 1 or less is considered as low-risk. A HQ of 2-10 requires extended mitigation measures. Herbicide use within all watersheds will be well-buffered from streams. Application of mitigation measures shown previously in this document, adherence to Forest Standards for herbicide use and chemical labels for application, as well as proper worker PPE and cleaning practices will negate HQs > 1.0 related to drift, accidental spills, worker exposure and run-off.

All herbicide application mitigation measures (as specified in this EA) and Forest-Wide Standards for herbicide application will be applied. These mitigation measures will greatly reduce the chance of workers being exposed and very slight risk for any public exposure to these compounds.



Glyphosate typical HQs associated with both foliar and cut surface application of this chemical at an application rate of 1.0 lbs/acre for humans are less than 1.0.

Hexazinone typical HQs associated with ground application of this chemical at an application rate of 2.0 lbs/acre for humans are less than 1.0, with the exception of chronic/longer term exposure related to an adult female ingesting contaminated fruit, or coming into contact with contaminated vegetation – both from foliar application (see Process Record for specific numbers). These upper bound HQs are not a concern because:

- Herbicide application areas are signed.
- Hexazinone has a moderate half-life of approximately 90 days.
- The risk assessment scenario assumes that contaminated fruit is eaten 90 days in a row.
- Blackberries, the only types of fruit likely to be available in any substantial quantity within treatment areas, are not ripe for such a long period.
- The risk assessment scenario assumes that the person remains within a treatment area for 90 days in direct contact with the chemical.
- Hexazinone will be applied in a spot grid pattern on the soil, not applied as a foliar spray.

For Imazapic and Imazapyr, none of the HQs calculated for risk scenarios to workers or the general public were above 1.0.

Triclopyr Amine and Triclopyr Ester have low bioconcentration potential and single dose toxicity to mammals is low although prolonged or repeated exposure may cause skin irritation in mammals (MSDS dated 1/17/2001). Typical HQs associated with both foliar and cut surface application of triclopyr applied at a rate of .36 to .48 lb/acre for humans are less than 1.0, with the exception of acute exposures related to a child drinking contaminated water from a chemical spill, an adult female consuming contaminated vegetation or fruit, as well as chronic/longer term exposure related to an adult female ingesting contaminated vegetation for 90 days (see Process Record for specific numbers). These upper bound HQs are not a concern because:

- Herbicide application areas are signed.
- Triclopyr will be applied by hand application on cut surfaces or specific foliage.
- Triclopyr has a moderately short half-life on average of 30 days.
- The risk assessment scenario assumes that the person remains within a treatment area for 90 days in direct contact with the chemical.
- The amount of non-target vegetation subject to spray deposition is very small and humans are less likely to come in contact with targeted treated vegetation, and even less likely to come in contact with chemical from cut surface application in woodland restoration areas.
- Adherence to Forest-Wide Standards, mitigation measures, chemical label application and handling guidelines and BMPs will severely limit the possibility of spills of concentrated chemical into surface water.

There is a risk of worker injury during the completion of manual/mechanical vegetation treatments, and prescribed fire. Proper use of PPE, adherence to job hazard analyses and

safety practices mitigate this risk. Risk to the public from these types of work is minimal. However, with proper handling/transport methods, use of signing in application areas (where required), use of proper application methods and equipment, and use of required PPE, risk of herbicide exposure to workers and the public is mitigated with implementation of alternative 2.

Removal of dead and/or aging trees through thinning operations and fireline preparation will make the forest safer for forest visitors, through reducing the incidence of falling snags and limbs.

The use of prescribed burning will lessen potential wildland fire occurrence, wildland fire severity and unplanned smoke emissions. Strict adherence to FEIS and RLMRP guidelines, a site-specific burning plan and Arkansas Voluntary Smoke Management Guidelines will limit the area where EPA standards are exceeded to a location very close in proximity to the flaming front. Site specific burn plans and Arkansas Voluntary Smoke Management Guidelines ensure that smoke or other combustion products do not reach, or significantly affect, smoke sensitive areas. Smoke monitoring during and after prescribed burns will be conducted to determine compliance with smoke management guidelines, and for potential future mitigation required for downwind smoke sensitive areas. These actions will ensure that the requirements of the Clean Air Act, EPA air standards, and state requirements will be met and there should be no smoke related long-term or cumulative effects from prescribed fire.

Downwind effects of reduced air quality will be short-term in nature. Impacting large population centers will be avoided. The acres burned under alternative 2 will occur over several days. Individual ignitions will generally be limited to 500 to 3,000 acres daily. Annually, ignition in the project area will be spread over several days, and probably over multiple seasons – thereby reducing potential for smoke impacts. All acres receiving prescribed fire will not be burned in one year. Ignition of all prescribed burn units described in this document will occur over the span of several years. It is anticipated that the maximum acres which will be burned annually will be approximately 5,000 acres. Use of aerial ignition will serve to reduce burn-out time and associated duration of smoke impacts. Aerial ignition will also help develop smoke column lifting and reduce smoke impacts.

Smoke concentrations from prescribed burning can be a very serious matter, particularly near homes of people with respiratory illnesses, near health-care facilities, or on roadways. Human health effects related to particulate matter in smoke include aggravation of respiratory or cardiovascular illnesses and changes in lung function, structure, and immunity capability of the body. Site specific burn guidelines and compliance with Arkansas Voluntary Smoke Management Guidelines provide daily smoke/particulate matter emissions, smoke sensitive targets to avoid, and mitigation required to limit negative effects of burning on human health and safety to the extent possible. The Forest Service complies with all applicable Federal and State regulations governing open burning. Additionally, adjacent private landowners, and known members of the public with respiratory health issues are notified before prescribed fires are ignited. If concerns related to human health exist, the USFS will accommodate that citizen in an effort to provide a safe and healthy environment during the burn (e.g., citizens with respiratory health issues will be given the option to stay in a hotel room provided by the USFS.)

When implementing prescribed fire, all precautions are taken to avoid damage to private property and minimize risk to worker and public health as per site specific burn plans, smoke management guidelines, standard fire safety guidelines and job hazard analyses.

Based upon the analyses, there should be no significant long-term cumulative effects on human health from implementation of herbicide use, manual/mechanical vegetation treatments, or prescribed fire associated with alternative 2. For additional information regarding smoke emissions from prescribed fire refer to the “Air Resources” section of this EA.

## **12. Social and Economic Factors**

### **Existing Condition**

The project is located in rural northwest Arkansas. The income levels are primarily moderate to low, and many local residents derive their income from harvesting timber and/or processing timber products. Local communities benefit from the taxes generated by timber activities. These benefits include social services such as law enforcement activities, safe drinking water, road maintenance/construction/reconstruction, and public school systems. These services contribute to an enhanced standard of living to the public within the area.

On October 30, 2000, Congress signed into law the “**Secure Rural School and Community Self-Determination Act of 2000**”, commonly known as Payments to States (Public Law 110-343). The Act addressed the decline in revenue from timber harvests in the last several years on Federal land, which has historically been shared with the counties in which National Forest (and BLM) land resides. The Act originally expired in 2006 and has been renewed several times (most recently in 2015) each time at reduced spending levels. These funds have been used by counties for schools, roads, and emergency activities.

On April 16, 2015, the **Secure Rural School Act** was reauthorized by section 524 of Public Law 114-10 for two more years. This allows counties to choose either 25% of the state’s 7-year rolling average, or to receive a share of the state payment using a “formula” that uses several factors such as acres of Federal Land, previous payments, and per capita personal income. Counties must obligate funds by September 30, 2017 (Title II) or by September 30, 2018 (Title III).

### **Direct and Indirect Effects**

#### **Alternative 1**

This alternative proposes no timber management activities. Therefore, there would be no economic benefits to the local communities resulting from jobs created by timber sales or money to be used for wildlife habitat needs Knutsen-Vandenberg (KV) trust-fund money.

#### **Alternative 2**

Activities selected will affect the local economy by supplying timber for local mills, employing loggers to harvest timber, hiring truck drivers, employing people to do site preparation, TSI/PCT, and wildlife habitat improvement work.

The revenues derived from the selling price of timber will contribute to school and road funds in Franklin County. At the time of the Brushy Mountain project economic analysis, hardwood sawtimber sold for \$71.18/ccf, hardwood pulpwood sold for \$8.12/ccf, pine sawtimber sold for \$51.01/ccf, and pine pulpwood sold for \$19.59/ccf. These figures reflect an average from several timber sales recently sold on the Ozark National Forest. Table 28 lists the Present Net Value of implementing alternative 2.

**Table 28. Efficiency analysis on the forest product revenues generated by Alternative 2.**

	No Action; Alternative 1	Alternative 2
Timber Volume (CCF)	0	41,675
PV Timber Revenue	0	\$1,897,038.43
Benefit/Cost Ration	0	1.10

Due to budget constraints and changes and current market values, the costs associated with projects being implemented several years out may change somewhat and would always need to be reviewed and weighed accordingly. Therefore, before this project is implemented, all costs for the project will be re-evaluated and be implemented only if the benefit/cost ration is favorable to the government.

### **Cumulative Effects**

Alternative 2 has a positive effect on the local economy in that it will provide revenue to the counties/schools, provide for local jobs, produce lumber at nearby mills and supply firewood to Forest neighbors. Economic benefits will also be realized through creation/improvement of wildlife and fisheries habitat. Benefits to the public will be realized through reduction of fire hazard and potential loss/damage to personal property through implementation of fuels reduction burning. Reduction in fuel loading will serve to reduce potential wildfire spread and severity, thereby reducing costs associated with fire suppression which far exceeds costs per acre for prescribed burning. Decommissioning and closure of roads will create social/economic benefits by reducing erosion and sedimentation. This will also serve to reduce the proliferation of unauthorized OHV use.

## **13. Management Areas, Scenery Management and Recreation**

### **Existing Condition**

The Brushy Mountain project area is primarily used by the public for dispersed recreation opportunities such as hunting and fishing. Redding Campground is the only developed recreation area within the project boundaries. Redding Campground is situated along the Mulberry Wild and Scenic River and is an extremely popular destination for many recreational users, especially in the spring and summer season when the river is flowing high enough to kayak or canoe. The campground provides 25 sites and has a bathhouse that is currently set up on a well-water system. The Arkansas Department of Health requires the Forest Service to collect and send potable water samples to the department of health for

proper testing. All potable water not obtained from a municipal source is required for testing to ensure the water is safe for human consumption. Municipal water is located within ¼ of a mile from the campground and would be convenient for the Forest Service to explore options of connecting to this source.

No existing OHV trails are designated within the Brushy Mountain project area and there are no plans to include this type of activity in the foreseeable future. Unauthorized, man-made OHV trails are common across the OSFNFs and as these trails are discovered within the project area, appropriate measures will be taken to close them.

## **Recreation**

The project area is classified as “Roaded Natural” in the Recreation Opportunity Spectrum (ROS) designations.

ROS is a method for classifying types of recreation experiences available, or for specifying recreation experience objectives desired in certain areas. Classes are Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Rural, and Urban.

**Roaded Natural** settings are located within a half mile of a road and usually provide higher levels of development such as campgrounds, picnic areas, and access points. It is defined as an area characterized by predominantly natural-appearing environments with moderate evidences of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities. The recreation opportunity experience level provided would be characterized by the probability for equal experiencing of affiliation with individuals and groups and for isolation from sights and sounds of humans. Opportunities for both motorized and non-motorized forms of recreation resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities.

## **Off Highway Vehicles**

OHV use is now restricted to Forest designated roads and trails. High-use areas are managed within capacities in order to maintain the quality of experiences. Facilities that provide access to the OHV system are created in conjunction with the development of the overall OHV system. Recreational OHV visitors are informed through the OSFNFs Back Country Guide which can be found at the Pleasant Hill Ranger District Office, (or any other District Office across the Forest) where designated routes are located, what types of vehicles are allowed, and what seasons the trails are open to public OHV riding.

## **Scenery Management**

The Forest Plan states that the desired condition for scenery management as the biological, physical, and cultural features of landscapes that provide for a "sense of place" as defined in the Landscape Character descriptions are intact. Landscapes possess a vegetation pattern and

species mix that is natural in appearance. Built elements and landscape alterations complement the lines, forms, colors, and textures found in the landscape.

#### Definitions of Scenic Integrity Objectives:

Very High	<b>VH:</b> (Unaltered-Preservation) Scenic integrity refers to landscapes where the valued landscape character " <b>is</b> " intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.
High	<b>H:</b> (Appears Unaltered-Retention) Scenic integrity refers to landscapes where the valued landscape character " <b>appears</b> " intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
Moderate	<b>M:</b> (Slightly Altered-Partial Retention) Scenic integrity refers to landscapes where the valued landscape character " <b>appears slightly altered.</b> " Noticeable deviations must remain visually subordinate to the landscape character being viewed.
Low	<b>L:</b> (Moderately Altered-Modification) Scenic integrity refers to landscapes where the valued landscape character " <b>appears moderately altered.</b> " Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed, but also compatible or complimentary to the character within.

The majority of the project area has a SIO of Low to High. The areas of SIO of High are concentrated along the Scenic Byway Corridor Management Area or State Highway 23 (Pig Trail Byway) and the Wild and Scenic River Management Area or Mulberry River.

The project area has visual diversity, with several areas of private ownership across the proposed project area, which consists of homes, weekend cabins, pasture for livestock, crops and private forested areas. Viewing from state highways, county roads and other primary forest roads consists mostly of steep mountains with mixed hardwoods and pine.

#### Scenic Byway

The Forest Plan states that the desired condition for Scenic Byways Corridors is that areas provide exceptional opportunities for motorized recreation, especially scenic driving. The views along the different byways vary, and include a variety of landscape characters, ranging from natural appearing to pastoral, historic, and cultural. They provide colorful accents and interesting textures, which change with the seasons. Visitors enjoy viewing wildlife in the occasional openings scattered through the Forests. Water or geographic features as well as cultural landscapes (such as hay fields, grazing livestock, and the occasional rustic cabin) provide scenic diversions to the predominately-forested landscape. Road corridor improvements and interpretive facilities are evident changes to the natural environment.

These manmade alterations fit well with the character of the surrounding landscape. Other management activities are not evident to the average visitor.

Vegetation is influenced both by natural processes and humans. Biological communities are maintained or improved to provide an attractive setting for visitors while providing for the protection of rare communities and threatened, endangered, sensitive, and locally rare species. Forest management activities maintain the natural characteristics that make the area scenic. Commercial timber harvest is appropriate to maintain the long-term goals of a diverse and vigorous forest with sensitivity to dispersed recreation and scenic values. Vegetation management operations would focus on what is retained in the stand, not on wood fiber production. Practices are visually subordinate to the surrounding landscape. Prescribed fire and other management treatments are appropriate vegetative management tools available to be used to enhance the byway corridor in conjunction with other resource values.

These corridor management areas are characterized by a predominance of mid- and late-successional forests. Forest structure varies according to ecological factors, but largely consists of a mature overstory; a fairly open midstory; and a well-developed herbaceous and shrubby understory. Understory vegetation includes a variety of native deciduous and evergreen flowering trees, shrubs, and wildflowers. Even-aged, two-aged, and uneven-aged forest communities along with medium and small patches of late successional to old-growth forest communities continue to develop throughout the area.

### **Wild and Scenic River**

In the spring of 1992, the Mulberry River was one of six rivers in the Ozark National Forest to be designated as a Wild and Scenic River and is the only designated river located in the Pleasant Hill Ranger District. The Mulberry River is situated on the north boundary of the Brushy Mountain project area within the Wild and Scenic Corridor Management Area (MA). The ultimate goal of this Management Area is to enhance and protect the outstandingly remarkable values and unique qualities of each river and its surroundings for people to enjoy a wide variety of river-oriented recreation opportunities.

The surrounding area of the Mulberry River provides a mix of habitats and successional stages for a wide variety of species that favor, or are tolerant of, habitat edges and human disturbance. Habitat associations being emphasized include mid-to-late successional deciduous associates and bottomland forest associates. Habitat conditions beneficial to mixed mesic associates and mix xeric associates (primarily xeric oak and xeric oak-pine habitats) are provided. These conditions provide suitable habitat for eastern wild turkey and marginal habitat for ruffed grouse. Management and protection of rare communities and species associates is provided along with management and protection measures for population occurrences for threatened, endangered, sensitive, and locally rare species.

Timber production is classified as unsuitable for this MA, however, management of vegetation is permitted within the river corridor to maintain outstandingly remarkable values. Management activities such as prescribed fire, commercial, and non-commercial felling of trees may be used for scenic enhancement or rehabilitation to provide wildlife viewing opportunities; maintain developed recreation facilities; improve threatened, endangered,

sensitive, and locally rare species habitat; restore native vegetative communities; restore riparian ecosystems; reduce unnatural fuel buildups; or control NNIS vegetation.

### **Direct and Direct Effects**

#### **Alternative 1**

There would be few short-term changes; however, as ecosystems in the project area progress, hardwoods would be expected to be an increasing component in the areas now dominated by pine; hardwood stands would be expected to progress toward containing a greater component of shade and fire-intolerant species. Visual color and pattern diversity, especially during leaf-off, would decrease with less of the contrasting green-gray patchwork patterns. Neither the ROS nor the SIO designations would be changed under this alternative.

Current issues of Oak Decline would continue to progress throughout the project area causing a change in the visual aspects of the area. The public would tend to see more dead or dying oaks as current conditions of the area worsen. This would also create more fuel buildup, increasing the chance of larger wildfires. Visitors may experience wildfires and more wildfire damage would be visible in the area as the current situation continues.

Road conditions would continue to deteriorate due to motorized vehicles using roads to gain access to the project area. Eventually roads would become impassable and the potential for users to create unauthorized new trails attempting to divert from impassable areas would most likely occur. The outcome of users creating new trails would result in heavy resource damage and increase the erosion rate thus having a direct effect to the water quality.

The outcome of alternative 1 would not move the management area from its current condition to desired conditions described in the RLRMP.

There are abundant opportunities for the public to use and enjoy the OSFNFs. Dispersed recreation activities include: canoeing/kayaking, swimming, hunting, fishing, hiking, picnicking, rock hounding, sightseeing, and camping.

Dispersed camping and hunting would be affected in the long-term under alternative 1 as it would not provide necessary management activities needed to maintain or increase habitat on public lands. Successful viewing of game and non-game species and hunting of deer and turkey may decrease on public lands under this alternative due to declining forest health.

#### **Alternative 2**

If funding becomes available, municipal water will be provided to the campground. This will reduce salary cost to the government by eliminating the need for an employee to collect water samples each week and hand deliver the samples to the Arkansas Department of Health facility in Clarksville, Arkansas. Typically, the Pleasant Hill office does not receive the results of these water sample for over a week in which they were sent. Municipal water would be treated on a regular basis to ensure it remained safe for public consumption.

Additionally, if funding is available and Forest Service policy permits, then the option of electrical utilities will be recommended for each campsite. This will increase the diversity of



recreational visitor as the campground will be able to accommodate RV campers with the addition of electric utilities at each campsite.

Oak decline will still occur; however under alternative 2, the Forest Service will be able to address issues of dead or dying oak in a timely manner. Vegetation treatments could be implemented to help alleviate large outbreaks of oak decline. Thinning's through mechanical means and prescribed burning will help reduce overcrowded conditions, thereby reducing stress of residual trees.

The public driving along state highways, county, and forest roads will notice more browning of vegetation from harvest, herbicide and burning activities during the initial work and the first growing season. However, long-term benefits are numerous as these activities will increase visuals and help create lush habitat for many wildlife species including game species such as the white-tailed deer and eastern turkey. Additionally, the forest will become more resilient to drought, insect infestations, and disease with fewer trees per acre.

Vegetation management in the Forests will allow views that penetrate further into the stands for a more park-like appearance and providing for a greater diversity of understory species. Tree removal will be varied in the near foreground to avoid uniform spacing and a tree-farm appearance. Slash clean-up in certain areas or prescribed fire (which will greatly reduce slash) in the first 200-300 feet in areas seen from travel ways and concentrated use areas will be completed.

Visitors to all areas of the project area may smell and see smoke during prescribed burning activities. Blackened trees and ground for the first season will be visible until the next spring green-up. Some browning of vegetation from harvest activities during the initial work and first season in stands along county and forest roads may exist. They may also notice an increase in log truck traffic during the logging operations. In the background, National Forest land will continue to offer viewers a variety of forest types from pines to hardwoods.

During prescribed burning and vegetation management activities, area closures will be implemented to improve visitor safety. At the conclusion of management activities and prescribed burning, certain roads could be closed, blocked and seeded. These activities will have no long-term negative effects on the dispersed recreation activities except with the use of closures on unauthorized user-created trails.

Recreation users may notice signs located on roadways in which certain management activities take place stating, *"This road is temporarily open for logging activities and will be closed to vehicle use when logging is completed."* These signs will be placed on all closed roads that are re-opened for this project. These roads will then be re-closed after project completion by either seeding the roadbed, gates and/or other closure structures. Roads closed with gates or earthen mounds will allow foot travel for hunters to access more secluded hunting opportunities. Roads that are closed may be used by hikers to access the interior of the project area. Reclosing roads will reduce the number of miles of roads on which users can drive motorized vehicles. Due to the implementation of the motor vehicle use policy, vehicles are allowed to drive only on designated routes within the project area. Forest-wide designated motorized use routes will be managed to maintain a high-quality experience.

The selected vegetation management and wildlife activities will improve hunting opportunities around the dispersed hunting camps and adjacent private lands. These vegetation treatments will also improve wildlife and bird viewing.

Hunters are frequently drawn to certain vegetation management activity areas because of visibility; deer are attracted to them also. Early seral-stage vegetation will increase in the commercially-harvested areas, areas of WSI, and wildlife openings. The TSI, woodland thinning, and prescribed burn areas also attract hunters. Hunting opportunities will increase with the selected action.

Members of the public that may be camping at dispersed sites will notice logging traffic, hear chainsaws, and see forest stands as timber-related and wildlife improvement activities occur. The public may see some short-term effects from other activities such as brown leaves in the prescribed burned and herbicide-treated areas, as well as areas where TSI/PCT work will be taking place. After the green-up of more beneficial ground vegetation, the opportunity of successful wildlife sightings and viewing will likely improve.

Maintaining a system of roads in the project area will allow outdoor enthusiasts to continue to enjoy the forest on foot and allow hikers access to areas for dispersed camping and hunting. Vegetation management, silvicultural treatments, riparian enhancements, and wildlife habitat improvements should increase numbers of both game and non-game species, so the recreational use in the form of wildlife viewing and hunting will likely improve.

### **Cumulative Effects**

Developed recreation use will improve with the addition of municipal water and electrical utilities. Campsites will provide a wider diversity of camping as each site will accommodate RV camping. Tent camping will most likely stay the same, however RV camping will increase under alternative 2.

Alternative 2 will not change the non-consumptive recreation use (camping, hiking, and mountain bicycling) in the project area. Many of the unauthorized user-created OHV trails will be eliminated through planned road decommissioning and closure of roads, thus improving the walk-in viewing of wildlife and hunting experience.

Based on the analysis, alternative 2 will not significantly affect any attributes which might make all or part of the vicinity suitable for proposal as a special interest area for dispersed recreation or scenic quality. This alternative complies with the 2005 RLRMP.

### **Part 4 – Consultation and Coordination**

A complete list of the interested citizens and neighbors of the forest is located in the Brushy Mountain project file. The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

**ID TEAM MEMBERS:**

<b>Name</b>	<b>Position</b>	<b>Office</b>
James Bicknell	Special Uses/Lands	Pleasant Hill Ranger District
Mary Brennan	Zone Archaeologist	Pleasant Hill/Boston Mountain Ranger Districts
Tom Cravens	Forester	Pleasant Hill Ranger District
Matt Pfeifler	Recreation/NEPA Coordinator	Pleasant Hill Ranger District
Jeremy Eubanks	Timber Management	Pleasant Hill Ranger District
Pat Kowalewycz	District Ranger	Pleasant Hill Ranger District
Dan Martin	Fire Management Officer	Pleasant Hill Ranger District
Greg Taylor	Wildlife Biologist	Pleasant Hill Ranger District
Steve Duzan	NEPA Coordinator	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR.
Keith Whalen	Fisheries Biologist	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR
Nelson Rolong	Soil Scientist	Natural Resource Conservation Service, Little Rock, AR.
Rick Arnold	Engineering Technician	Pleasant Hill Ranger District
Rick Monk	Forest Hydrologist	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR
Dylan Farnam	Timber Sales Administrator	Pleasant Hill Ranger District
Brian Barns	GIS	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR

**FEDERAL, STATE, AND LOCAL AGENCIES:**

<b>Name</b>	<b>Position</b>	<b>Office</b>
Melvin Tobin	Fish & Wildlife Biologist	U.S. Fish and Wildlife Service, Conway, Arkansas
<i>Various Persons</i>	Deputy State Historic Preservation Officer	Department of Arkansas Heritage
Ben Gentry	Engineering Technician	Ozark-St. Francis National Forests, Supervisor's Office, Russellville, AR

**NATIVE AMERICAN TRIBES/NATIONS:**

<b>Name</b>	<b>Location</b>
Caddo Indian Tribe of Oklahoma	Binger, Oklahoma
Cherokee Nation of Oklahoma	Tahlequah, Oklahoma
Osage Nation	Pawhuska, Oklahoma
Quapaw Tribe of Oklahoma	Quapaw, Oklahoma
Tunica-Biloxi Tribe of Louisiana	Marksville, Louisiana
United Keetoowah Band of Cherokee Indians	Tahlequah, Oklahoma
Jena Band of the Choctaw Indians	Jena, Louisiana

## Part 5 – Appendices

### APPENDIX A – Forest Type and Condition Class Codes

**Forest Types** (first 2 digits of the 4 digit code-- **XX**xx)  
(species listed by occurrence in stand)

- 11 - Eastern Red Cedar and Hardwood
- 12 - Shortleaf Pine and Oak
- 13 - Loblolly Pine and Oak
- 25 - Yellow Pine
- 31 - Loblolly Pine
- 32 - Shortleaf Pine
- 35 - Eastern Red Cedar
- 43 - Oak and Eastern Red Cedar
- 44 - Southern Red Oak and Yellow Pine
- 47 - White Oak, Black Oak and Yellow Pine
- 48 - Northern Red Oak, Hickory and Yellow Pine
- 49 - Bear Oak, Southern Scrub Oaks and Yellow Pine
- 51 - Post Oak and Black Oak
- 53 - White Oak, Red Oak and Hickory
- 54 - White Oak
- 55 - Northern Red Oak
- 63 - Sugarberry, American Elm and Green Ash
- 68 - Sweet Bay, Swamp Tupelo, Red Maple
- 69 - Beech, Magnolia
- 72 - River Birch and Sycamore

**Stand Condition Class** (last 2 digits of the 4 digit code--xx**XX**)

**Even-aged Management Codes:**

- 01 - In regeneration
- 02 - Damaged Poletimber
- 03 - Damaged Sawtimber
- 04 - Forest Pest Infestation
- 05 - Sparse Poletimber
- 06 - Sparse Sawtimber
- 07 - Low Quality Poletimber
- 08 - Low Quality Sawtimber
- 09 - Mature Poletimber
- 10 - Mature Sawtimber
- 11 - Immature Poletimber
- 12 - Immature Sawtimber
- 13 - Adequately Stocked Seedlings and Saplings
- 14 - Inadequately Stocked Seedlings and Saplings
- 15 - Non-stocked
- 0000 - Pastures or other Special use areas

**Uneven-aged Management Codes:**

- 16 - Group Selection Management (Hardwood)
- 17 - Individual Tree (Single-tree) Selection Management (Pine)

## **Appendix B**

Characteristics of forest stands receiving silvicultural treatments in the Brushy Mountain project.

<i><b>Compt.</b></i>	<i><b>Stand</b></i>	<i><b>Forest Type*</b></i>	<i><b>Condition Class*</b></i>	<i><b>Age Year</b></i>	<i><b>Pine Basal Area (sq.ft./acre)</b></i>	<i><b>Hardwood Basal Area (sq.ft./acre)</b></i>	<i><b>Site Index</b></i>
411	1	25	12	1974	85	25	70
	6	32	12	1969	80	10	70
	7	31	12	1978	110		70
	8	53	12	1930		120	70
	15	32	12	1970	80	22	80
	21	32	12	1960	95	10	80
412	3	32	12	1957	90	20	70
	7	32	12	1968	130	14	65
	10	32	12	1968	180	10	70
	11	32	12	1957	150		60
<i><b>Compt.</b></i>	<i><b>Stand</b></i>	<i><b>Forest Type*</b></i>	<i><b>Condition Class*</b></i>	<i><b>Age Year</b></i>	<i><b>Pine Basal Area (sq.ft./acre)</b></i>	<i><b>Hardwood Basal Area (sq.ft./acre)</b></i>	<i><b>Site Index</b></i>
	12	25	12	1976	200		70
	13	32	12	1930	79	20	70
	15	53	10	1915		105	80
	18	53	12	1930		105	70
	24	53	12	1930		103	70
	25	32	12	1974	153	7	70
413	1	32	12	1935	80	10	80
	2	25	12	1966	158	5	60
	3	32	12	1966	130	10	60
	6	32	12	1957	135	11	63
	10	25	12	1986	125		70
414	7	32	12	1936	140	16	78
	11	31	12	1975	140		80
	12	32	12	1973	3	120	80
	13	32	12	1974	180		70
	14	32	12	1974	160		60
	15	32	12	1977	145	3	80
	16	31	12	1977	150	15	70
	17	25	12	1985	123	70	
	22	32	12	1933	110		60
	24	32	12	1960	150		60
	29	32	12	1964	120		70
415	7	32	12	1967	110	5	70
	19	32	12	1960	120	2	80

	20	32	12	1960	95	3	80
	21	32	12	1960	140		70
	33	32	12	1976	190		70
	35	53	12	1925		94	70
416	2	32	12	1959	85		80
	6	31	12	1960	150		80
	8	32	12	1960	85	5	80
	10	53	10	1920		72	80
	13	31	12	1980	205		70
	14	31	12	1984	100		80
	23						
416	23	32	12	1968	120	8	70
	25	32	12	1967	120	14	70
	27	32	12	1967	92	80	
	34	53	12	1920		110	70
	37	32	10	1923	70	10	60
	42	53	12	1930		80	70
	43	53	12	1930		85	70
	45	32	12	1967	95		80
417	1	32	12	1986	135		70
<i>Compt.</i>	<i>Stand</i>	<i>Forest Type</i>	<i>Condition Class</i>	<i>Age Year</i>	<i>Pine Basal Area** (sq.ft./acre)</i>	<i>Hardwood Basal Area (sq.ft./acre)</i>	<i>Site Index</i>
	7	32	12	1982	130		60
	12	53	10	1905		90	60
	16	32	12	1936	140		80
	17	32	12	1960	143	3	80
	23	32	12	1960	160	3	70
	26	31	12	1977	185	2	70
418	8	32	12	1962	95		70
	23	32	12	1975	130	14	70
	25	32	12	1962	95	4	70
	27	32	12	1962	90		70
	29	32	12	1962	110		80
	31	32	12	1962	100	12	70
	38	32	12	1962	90		80
	41	32	10	1925	80	14	70
	43	32	12	1975	90	8	70
442	2	31	12	1976	140		70
445	19	32	12	1962	110	10	90

(\*Forest Type & Condition Class codes are explained in Appendix B

\*\*Basal areas are an indication of stand density (proximal distance between trees) in both pine and hardwood forest areas. Basal areas that average between 60-80 square feet for trees 14-18 inches in diameter are considered the ideal healthy stocking level for most forest stands.)

## **APPENDIX C - References**

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